ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXIII, No. 20. CHICAGO, SATURDAY ,NOVEMBER 15, 1913. ISSUED WEEKLY.

COMPRISING

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY

608 SOUTH DEARBORN STREET

CHICAGO

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SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada..... 4.00
One Year, Foreign Countries..... 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS:
- The Specifications and the Profits on the Job..... 953
- Pumping for Irrigation..... 954
- Advertising Specific Service Achievements..... 954
- Wiring for Future Service..... 955
- Moving Pictures and Electrical Advertising..... 955

DEPARTMENTS:
- Commercial Practice 964
- Electrical Construction 967
- Dollar Wiring Kinks..... 973
- National Association of Electrical Inspectors..... 974
- Public Service Commissions..... 976
- New Electrical and Mechanical Appliances..... 987
- Current Electrical News..... 992
- Record of Electrical Patents..... 998

LEADING ARTICLES:
- The Use of Electricity in Irrigation for Intensive Farming.—By D. R. Palmquist..... 959
- The Electrical Work in a Modern Residence..... 967
- Safety Devices in a German Electrical Factory..... 980
- The Relative Power Requirements of a Motor and Its Control Equipment.—By M. D. Goodman..... 982

BOOK REVIEWS 985

MISCELLANEOUS:
- The Society for Electrical Development and the Electrical Manufacturers 956
- National Association of Purchasing Agents Formed..... 956
- International Wireless Research..... 956
- E. J. Nally..... 957
- Annual Dinner of the Commonwealth Edison Section..... 957
- International Marconi Wireless Developments..... 958
- Cost of Pumping by Electricity..... 964
- Motor Drive for Mine Pumps..... 964
- Twenty-two Reasons for Using Central-Station Power..... 965
- Commonwealth Edison Contract Department Discusses Electric Vehicles 966
- Effects of Registration of Electrical Contractors..... 971
- Guarding Electrical Contractors' Interests..... 971
- Wiring Lamps for Protection From Burglars.—By B. H. Fisher 972
- The Use of Refrigerating Apparatus to Aid in Cooling Dynamos on Overload.—By Sydney F. Walker..... 977
- Production of Poles in Canada in 1912..... 979
- Total Mechanical Horsepower in the United States..... 979
- Electric Restaurants in Europe..... 982
- Electric Iron-Ore Smelting in Sweden..... 984
- Wireless Progress 986

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THE SPECIFICATIONS AND THE PROFITS ON THE JOB.

In an address before a convention of electrical contractors not long ago a speaker exhibited a large cartoon which was supposed to represent a contractor who had just found himself the successful bidder on a big installation of electrical work. Instead of depicting a man in the happy frame of mind that success in getting business ought to induce, the cartoon showed what was evidently a very miserable individual. He had been going over the job trying to discover all that he had forgotten to include in his bid, and it was what he had found that was supposed to be the cause of his wobegone appearance.

Pictures like this might be funny sometimes if the conditions they illustrate were less real and less disastrous to the contracting business. Much too often is it true that it is what the contractor forgets and the impossibility of obtaining a comprehensive understanding of important details, at the right time, that leads to his being awarded a contract. In other words, the specifications are at fault. The contractor is given a set of drawings which were made by a man who knew next to nothing about details of the kind of work that is to be done, and which are therefore ambiguous and incomplete; accompanying these there is a set of written specifications which consist mainly of paraphrased portions of the National Electrical Code; and from this batch of illuminating data he is called upon to make up an estimate of a fair price for the installation.

Moreover, it is frequently the case that the time allotted him to get in his bid is entirely too short for the study and inquiry necessary to an understanding of construction on which the specifications are so incomplete. He and his competitors go to work to make up their estimates, and that one of them who has the least skill in reading the mind of the architect or his engineer, or whose memory as to details and the cost of them is poorest, gets the contract. This man then spends the next few days trying to find out just how much he overlooked in arriving at his price—and rather often finds it to be so much that he can see no way at all of saving himself, except through extras and poor work. The chances are that a really good job, without an excess of extras, would mean a total absence of profit, if not indeed an actual loss of money.

The above picture is scarcely overdrawn. It is a

condition that is distinctly bad. And it is one that the contractors themselves must remedy if a remedy is to be had. So long as men are willing to bid on cheap and inadequate specifications, cheap and inadequate specifications there will be. The National Electrical Contractors' Association has worked out and adopted a set of symbols for use in wiring plans. It would seem that work in this direction ought to be continued until something akin to a standardization of specifications for electrical construction was brought about. Improvement is certainly needed, and it is hard to see why it is not altogether possible.

PUMPING FOR IRRIGATION.

The importance of pumping for irrigation as an electric motor load is well recognized in the arid regions of the West and the connected load of this type has reached large proportions on a great many power circuits. In most regions where this pumping is employed it is absolutely necessary to the use of the land for farming or orcharding, at least if any crops are to be raised other than those suited to dry farming.

That irrigation is worth while in many other sections of the country where crop production is usually dependent upon the natural rainfall is pointed out in an article in this issue by Mr. D. R. Palmquist. While the larger part of this country has a sufficient annual rainfall to meet the requirements of the usual crops if the water were available when most needed, it is seldom that the latter condition is met. To obtain the best results and the largest yields, it is necessary that moisture shall be available at the proper period of plant growth. Where dependance is placed upon natural rainfall this is an entirely fortuitous circumstance and in the long run the moisture is not available in sufficient quantities at the time when most needed. While droughts of a nature which permits the vegetation to be burned up are infrequent for considerable areas of the country, too dry condition for the best plant growth is quite common in nearly all sections. Provision for a supply of water at such times may make all the difference between a bountiful crop and a poor one.

Central stations in the eastern and central portions of the country should consequently find a field for electric pumping, even where farming is at present carried on without any assistance of this kind. If the farmer can be convinced that an electric installation would not only provide insurance in bad years, but would increase the yield very materially in nearly every year, he is likely to look with favor upon an equipment of this kind. For a solicitor to handle this work in an intelligent manner it is not sufficient that he be versed merely in the characteristics of motors and the general advantages of motor drive, such as would appeal to the factory manager. It is necessary that he equip himself with a knowledge of crop raising and its dependance upon moisture that will permit of intelligent discussion of irrigation problems. He must be capable of assisting the farmer in the selection of a plant adapted to his particular needs and should be able to determine the amount of water which shall be adequate under particular conditions and to plan an installation which will supply this at the minimum cost, which should be determinable beforehand. This requires a thorough knowledge of soils in his territory, of the crops which are suited to it, and of the moisture requirements of these crops. He should also know the conditions for obtaining water by means of wells or otherwise in order to recommend an appropriate installation. He should also be familiar with the average revenue derived from various forms of crops common to his territory in order that he may be able to forecast the expenditure which would be warranted in augmenting this revenue by a definite percentage.

While much of the above may seem beyond the proper scope of the central-station solicitor, and while familiarity with all these factors will require a large amount of work and study, it has been shown in many regions of the West that the farmer will be educated to the use of electric power only through such efforts upon the part of central-station companies, and that when such information is available it is possible to secure large numbers of contracts providing a most desirable load. Unless the solicitors are capable of discussing the irrigation question in an intelligent manner, it is not likely that much headway can be made in this direction.

ADVERTISING SPECIFIC SERVICE ACHIEVEMENTS.

There are at least two directions in which the efficiency of central-station advertising can be improved. In both the requisite appeal depends upon more specific publicity of central service accomplishments. One line of attack is through the emergency installation and the other through the adoption of service by a business house or manufacturing plant whose management has decided to modernize operation according to the most approved methods. The use of specific examples is the one feature which will command the attention of the average newspaper reader whose eye instinctively takes in a pithy set of details about some actual achievement of the local service and as instinctively passes over hackneyed forms of advertising which perhaps show little more than the company's name and address with the words "Light" and "Power" in the corners.

Suppose a steam-engine cylinder head blows out and shuts down a factory for a costly and indefinite period. This happened in an Eastern skate-making plant a few days ago and the establishment, a concern of national reputation, was industrially paralyzed until the local central station came to the rescue. Within 29 hours after the accident happened 1,100 feet of underground cable had been installed, three 50-horsepower motors were secured by express from the nearest factory producing electrical equipment, and electricity was being supplied. The manufacturer's decision to change over to electric

drive and the promptness with which the service was installed prevented a long shut-down and the loss of hundreds of dollars. Now the central station company did not rest content with this exceedingly rapid and effective performance, but told the story in a 5-by-10-inch newspaper advertisement on a subsequent Sunday, emphasizing the striking feature of the affair in a readable way, avoiding much technical detail and yet stating the main facts in a manner of real interest to the engineer as well as to the public.

In another case a furniture house erecting a new building was prevailed upon to adopt central-station service. The fact was at once extensively advertised in connection with the new building's construction; a large electric sign calling attention to the service to be installed was placed upon the front of the building where it could not but be seen from every street car passing by the place over the most congested stretch of track in the city; and in brief but suggestive display the local press featured the number and capacity of motors and lamps assigned and the general uses of power to be made. Here again the issue was driven home in the public mind while popular interest was live in the erection of the new structure; the time and place of the advertising were admirably selected, and much favorable comment stimulated.

Work of this character depends for success upon the ability of the central-station manager to scent newsy material for display. In towns large enough to render newspaper advertising profitable, there are many occasions where the central-station contributes in a striking way to the advance of the local business facilities or to the reduction of losses unpreventable under the old methods of operation, and if these are perfectly spread before the people lasting good is accomplished in the popularizing of electrical service.

WIRING FOR FUTURE SERVICE.

One of the very best ways in which to promote the use of domestic appliances is to insist that the future installation of these be provided for when the house is wired. For example, the fact that it would be necessary to install larger service wires and to tear up floors and run an additional circuit all the way from service entrance to kitchen might of itself be sufficient to cause a householder who was considering investing in an electric range to decide not to make the investment. Circuits like this ought to be installed when the building is wired. The present expensiveness of the appliance is small argument against providing for its installation at some future time; improvements in the design of apparatus and reductions in cost of power may soon remove this objection. The house should be wired for future requirements as well as for present needs.

MOVING PICTURES AND ELECTRICAL ADVERTISING.

The unabated popularity of the moving-picture show is rapidly becoming a factor of importance in electrical advertising. By this method, effects previously unseen can be displayed upon the screen and publicity of an absolutely novel kind obtained at a comparatively low cost in proportion to its benefits. Thus, in a reel now being shown upon a noted Eastern vaudeville circuit, the various operating steps in establishing a telephone connection between a Colorado mine and a New York hotel are shown by motion pictures in combination with a map of the United States. The progress of the call through each toll district is shown by an advancing band of light upon the map; the handling of the switchboards in this connection at Denver, Chicago, Buffalo and New York is displayed in realistic fashion; and finally, when the conversation has begun, it is shown in full-sized views upon the screen and also demonstrated by miniature moving pictures upon the map.

Incidentally the display informs the public that $1,000,000 worth of plant is tied up in such a conversation and before the scene has closed the audience is given an excellent idea of the methods of cable-laying, splicing and other practical tasks which are eye-openers to the layman. It is significant that this reel called forth a vigorous round of applause from an audience which observed a few moments later an intensely dramatic scene in a picture play by noted actors without a single evidence of enthusiasm.

Such applications of the cinematograph are received with keen interest by the public, which in America at least has a penchant for seeing "how things work" in every branch of industry. It would be trite to point out the educational value of such displays or their influence upon the popularization of electrical service. That phase of the matter is practically self-evident. What is desirable is that fresh and new methods of campaigning be developed along with the photographing of routine work, methods which combine graphic displays with pictures and make the relation between plant and consumer more real and direct. The possibilities along this line in connection with the exhibition of the steps taken in filling a service application, for example, are well worth taking up. The appearance of the prospect at the office of the central station, his signing of the contract, the machinery set in motion to serve him, system diagrams in elementary form and the actual operation of plant, work of line and inside construction forces, and finally, the comforts and low cost of the service can all be set forth effectively. Here is a field in which the imagination can be used to help the development of the industry, and we look to see some interesting results along these lines in the near future.

The Society for Electrical Development and The Electrical Manufacturers.

It will be of interest to manufacturers, as well as to the other branches of the electrical business, to know that forty-one manufacturers have taken out membership in the Society for Electrical Development, aggregating over $80,000 annually as their subscription to this very important trade movement. The particular group of forty-one referred to are members of the Electrical Manufacturers' Club, at whose meeting last week in Hot Springs the Society was a live topic of discussion both in the meeting and the lobbies.

The affiliation with the Society of the other members of the Club is being carefully considered, and their cooperation will undoubtedly raise the subscriptions from this particular group to over $100,000 annually.

The president of the Club, S. O. Richardson, Jr., in introducing the subject, gave the movement his warm personal endorsement, backed by the statement that his interests, the Libbey Glass Compainy, joined some months ago. J. Robert Crouse, in a brief address, emphasized the basic principles involved with special reference to the manufacturers. Gerard Swope, vice-president of the Western Electric Company, followed, explaining the detail plan of organization and the balanced representation of the grand divisions of the business. He expressed the opinion that the plan and personnel of the officers and directors gave every promise of efficient and economical expenditure in the work.

F. S. Terry, manager of the National Lamp Works, addressed the meeting with reference to results which the Society can accomplish. He explained that the result of the earlier efforts in this same work in 1906 and 1907 had greatly exceeded expectations, and indicated an efficiency in market development by these methods which can not be attained in any other way.

During the meeting President Richardson received over 50 telegrams from electrical supply jobbers in all parts of the country, stating they were members, expressing their conviction of its value and the hope that all the manuafcturers would join in the movement.

There are, of course, many manufacturers not members of the Electrical Manufacturers' Club, so that the figures given in the beginning of this item are less than the actual facts.

It is felt by many men prominent in the industry that the Society's objects, plans and methods of membership need only to be really understood to make a successful appeal to those who have not yet joined as it has done to the 700 and more companies in membership, and that it is in effect a wonderful opportunity for the electrical business to blaze a new trail in creative market development that will be in keeping with the great achievements in electrical research, engineering, and manufacture.

A pamphlet covering concisely the principles, plans and method of membership will be sent on request to the Society for Electrical Development, Engineering Societies Building, New York City.

Although the Society for Electrical Development has not as yet commenced its active work, the importance of the position it occupies in the electrical field has been repeatedly demonstrated during the past few weeks by the number of inquiries on electrical questions which it has received.

This early use of the Society's services and facilities indicates that in the course of a very short time it will come to be known as the great central source of authentic electrical information.

It is interesting to note the scope of the various inquiries already made. These include a request to recommend the best make of artificial limbs; numerous inquiries as to the rates for current charged by central stations in various cities; many inquiries for moving-picture film service; requests for suggestions for methods of embellishing street fairs; inquiries as to electrical exhibition cars; requests for advice as to window dressing for electrical jobbers and supply dealers; advice in regard to advertising copy; inquiries for names of possible agents abroad, and numerous inquiries for the names of manufacturers of certain electrical apparatus.

National Association of Purchasing Agents Formed.

An organization which will be known as the "National Association of Purchasing Agents," was formed at the Hotel McAlpin, New York City, on Thursday, October 16. H. T. Leeming, of Thomas A. Edison, Incorporated, was elected temporary chairman, and Elwood B. Hendricks, the organizer of the association, was elected temporary secretary and treasurer. The association will be devoted to the interests of purchasing agents, and buyers for the purpose of establishing mutual acquaintance on the exchanging of ideas and opinions, with the standardization of purchasing routine and methods. The headquarters at present will be at the Hotel McAlpin, and the address of the secretary will be P. O. Box 1406, New York City.

International Wireless Research.

Acting in accordance with its announcement of a year ago that it intended to organize and encourage electrical research, the Institution of Electrical Engineers (England) is forming the British National Committee which shall cooperate with other national committees in wireless research and experiment. The combined committees will meet at least once a year, thus constituting an International Wireless Commission. The commission will have as its first president W. Duddell, president of the Institution of Electrical Engineers. Robert Goldschmidt, whose high-power station at Brussels, together with a sum of $10,000 he has placed at the Commission's disposal, will act as secretary. The Commission will carry out experiments on the propagation of electric waves, while it will also make wireless measurements and study problems connected therewith. Measurements will be made in different countries, and at different distances, and in different directions, of the strength of signals sent out from the Brussels station, and these measurements will be repeated daily or hourly as may be considered desirable, with a view to determining the variation of the signals with time, distance and direction. Study of wave-length and decrement effects will follow later.

A specially erected receiving station at Brussels will accurately control the strength of the waves sent out from the transmitting station near by, in order that in arriving at results allowance can be made for avoidable variation. The first signals will be sent on January 1, 1914, with a 3,300-meter wave-length, and they will continue twice a day for three days a week.

Testing of Water Turbines in Hydroelectric Plant.

At the next joint meeting of the Chicago Section, American Institute of Electrical Engineers and the Electrical Section, Western Society of Engineers, which is to be held on the evening of November 24 in the Monadnock Block, Chicago, Lucius B. Andrus, superintendent of the Indiana & Michigan Electric Company, will present a paper on "Testing of Horizontal Low-Head Water Turbines." The turbines tested are in the Eikhart, Ind., hydroelectric plant.

Pacific Coast Telephone Society.

A society whose aim is the study of matters pertaining to the telephone and telegraph business by means of the presentation and discussion of technical papers by the members at stated meetings was recently organized at San Francisco under the name of the Telephone and Telegraph Society of the Pacific Coast. A banquet was tendered the Society on October 28 by the Pacific Telephone & Telegraph Company.

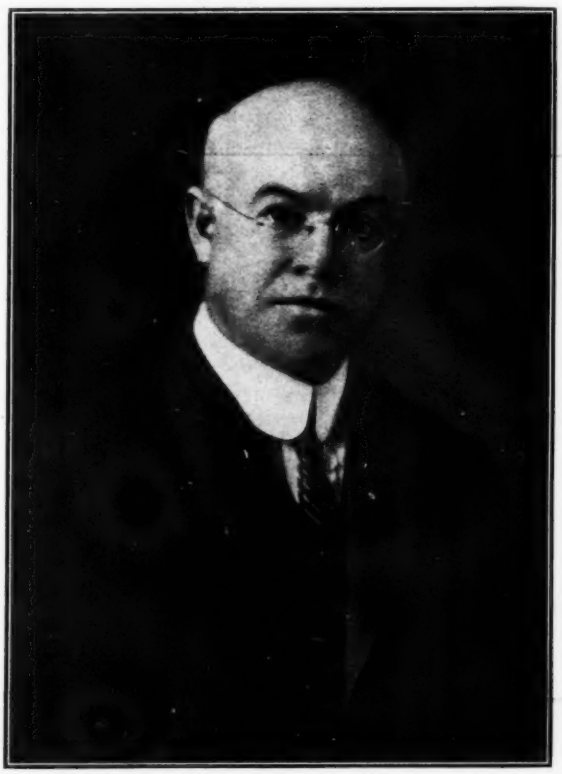
E. J. Nally.

In the development of any great enterprise, vision and imagination are generally the elemental factors that shape into consciousness the original conception of what is to follow. Courage and aggressive attention to mechanical details and executive requirements go hand in hand with vision and imagination in making staple the development of the enterprise. The individuals possessing all these attributes are hard to find, and the organization is indeed fortunate if among a large number the characteristics are available in some degree or other. When, however, one individual possesses not only vision and imagination, but the ability to undertake the working out of the practical details of the enterprise and the experience and talent to manage the executive departments as well, the organization is not only fortunate, it is lifted into an extraordinary position.

So, with the election of Edward J. Nally on October 1, as vice-president and general manager, director and member of the executive board, the Marconi Wireless Telegraph Company of America is to be congratulated.

Mr. Nally's whole life has been one of persistent endeavor in the maintenance of high ideals of service. Service to the employer to whom he has been directly responsible in the first instance, and service in the second instance to the great public which the corporations with which he has been connected have served. Mr. Nally has been connected with the telegraph service for 38 years, and is really a pioneer in the telephone industry, having had charge of the first Edison telephone in St. Louis before he had attained his majority. In the telegraph service he has risen from every grade from messenger boy to the vice-presidency and general managership of one of the great telegraph corporations.

Edward J. Nally was born in Philadelphia, April 11, 1859. He became a messenger boy for the Western Union Telegraph Company in St. Louis, in 1875. The record shows that he was a mighty good messenger boy, and because he had devoted himself to his work in a way that was an example to the other lads, he was picked out for early and rapid promotion. In 1878 he became a clerk in the office of Colonel Robert C. Clowry, then superintendent of the Western Union in St. Louis. Later on he went into the office of I. McMichael, late vice-president and general manager of the great Northwestern Telegraph Company, at Minneapolis, Minn. He resigned from this post on October 20, 1890, and shortly afterward became general superintendent of the Postal Telegraph Cable Company in Chicago. His work was here attended with great success, and advancing by several steps he was appointed vice-president and general manager on April 11, 1907. He retired from the Postal Telegraph Company on July 1, 1913.



Edward J. Nally,
Vice-President and General Manager of the Marconi Wireless Telegraph Company of America.

In addition to his busy career in the development of the telegraph industry, he has devoted a great deal of time to improvements of the conditions of those working about him, and has been instrumental in the establishment of savings and investments associations, employees' libraries, reading and resting rooms, and other welfare features.

Chicago Electric Club.

At the meeting of the Electric Club, Chicago, on November 6, an address was made by Robert M. Sweitzer, clerk of Cook County, on the subject of "Taxes and Taxation."

Two amendments to the Constitution were adopted.

Annual Dinner of the Commonwealth Edison Section.

The sixth annual dinner of the Commonwealth Edison Section, National Electric Light Association, was held at the Hotel Sherman, Chicago, on Thursday evening, November 6. About 300 members and guests were present, including officials of the Peoples Gas Light & Coke Company and the Elevated Railways Company.

W. L. Abbott, president of the Section, introduced the speakers of the evening, of whom the first was Samuel Insull, president of the Commonwealth Edison Company. Mr. Insull spoke of the future of the Section, of the work it had done, and also of the saving fund and the service-annuity system of the company. Following Mr. Insull, J. F. Meagher, of the Peoples Gas Light & Coke Company, presented the other side of the subject in an entertaining talk, "Our Friends, the Enemy." This was followed by the report of the president of the section, and the introduction of the new president, F. J. Arnold. Mr. Arnold spoke briefly about the work planned for the coming year in order to keep the section at its present high standard and to increase the membership. Entertainment was provided by an excellent minstrel show, and also by the company section orchestra which furnished music before and after the dinner.

Another Electrical Farm.

The new $150,000 mansion which James J. Hill is having constructed at North Oaks on his 7,000-acre farm near White Bear, Minn., will be equipped to utilize electricity to the fullest extent. Electric power will also be used for various farming operations, the total connected load amounting to about 65 horsepower. Electrical energy will be supplied North Oaks by the Stillwater Division of the Consumers Power Company, a Byllesby property. Prior to signing a five-year contract with the Consumers Power Company, Mr. Hill had experts investigate the advisability of an isolated power plant, but eventually decided in favor of central-station power. Many inquiries are being received by the Stillwater Division from farmers desirous of using electrical energy for both lighting and power purposes. A considerable increase in this class of business is expected next spring, which the company is preparing now to handle.

International Marconi Wireless Developments.

Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America, returned on October 29 on the steamship *Imperator*.

Mr. Nally has been abroad on wireless business, visiting the principal high-power stations of the Marconi Company, at Clifden, Ireland; Carnarvon and Towyn, Wales; the two latter nearing completion, are being erected for trans-Atlantic telegraph service in connection with the two powerful stations which the American Marconi Company is building at Belmar and New Brunswick, N. J., respectively.

These new stations, most complete and remarkable in their equipment and design, will, Mr. Nally asserts, mark an epoch in the history of long-distance wireless telegraphy, and will revolutionize the business of trans-Atlantic communication.

They will be completed and start service the first of the coming year, when the Marconi Company will make a strong fight for the trans-Atlantic business, offering the public satisfactory service and rates.

New high-power stations of the same type are being erected near San Francisco, also in the Hawaiian Islands, for trans-Pacific wireless service with the Orient. Japan will soon have its station completed, and later it is planned to construct similar stations in the Philippines and China.

Work will soon begin on a high-power station near Boston, to work with a similar station now being built by the Norwegian Government for handling the traffic of Northern Europe, and other stations of the same improved type and great capacity will be erected to form a chain of wireless communication for commercial purposes with Brazil, Argentine and the principal places in South America. Brazil has signed a fifty-year concession with the Marconi Companies.

The part played by the Marconi Wireless in the *Volturno* rescues created the most profound impression in England and on the Continent, and the world is beginning to show that it owes a great measure of honor and glory to the name of Marconi for the inventor's wonderful achievement in science and engineering, practically applied.

Mr. Nally, speaking of the development of wireless communication between ships at sea and between ship and shore, says:

"Few persons ever think of another fact of most vital importance to the continued use, without hitch, of Marconi's invention, now a common factor in our daily lives, increasing our personal comforts as well as our business facilities and providing a constant means of livelihood for increasing thousands of employees of all grades.

"I refer to that marvelous organization which has been built up side by side with the technical development of wireless on board ship. I think I may trace its origin to the basic business axiom, laid down by Marconi and his aids, from the outset, that it was not right to sell their installations, drawing immediate profit, and then leave their clients to work out their own salvation. They realized at once, that it would avail a ship-owner nothing to be possessed of a plant, working it how and when he willed, if other ship-owners did not work on similar regulations and methods.

"The question of language between ships of different nationalities is of much more complex nature than it is on the land lines of the Continent, for instance. A Swiss operator may talk to operators in neighboring countries of three nationalities; one wireless operator at sea may communicate during his voyage with operators of as many as twelve nationalities beside his own.

"Added to the language difficulties there is that presented by the different manner of doing things in different countries and ships—different sense of responsibility, of initiative, and ideas of discipline.

"All of these obstacles were obviously almost insurmountable if apparatus were to be disposed of finally by the manufacturer to each and every ship-owner, the latter being left to his own resources to reap the best benefit he could.

"Clearly there was to be an international creation, not only to supply the ship-owners with apparatus of recognized efficiency and uniform standard, but also to supply him with operators corresponding to the nationality of the ship, trained on uniform lines, possessing the same esprit de corps, subject to the same rules and regulations, and, however numerous their nationalities, all having a fair knowledge of one common language. In this direction, and in this direction only, was it felt that wireless could be applied successfully at sea.

"Accordingly, after Marconi had developed his invention to an extent at which its utility to shipping was obvious, the Marconi International Marine Communication Company, Limited, was constituted for the object I have mentioned, and how wonderfully and effectively it has succeeded, is the evidence of history as recorded in the *Republic*, *Titanic* and *Volturno* disasters, and in the many unrecorded instances of daily travel by sea.

"A good deal has happened since the conception and realization of the international wireless scheme. The rapidly increasing use of the wireless on board ships and the vast systems planned and in progress of international long-distance wireless, to compete with cables, rendered desirable the formation of national corporations in all the principal countries, and companies associated with Marconi have been constituted in New York, Montreal, Paris, Berlin, Rome, Brussels, St. Petersburg, Madrid, Argentine and Sydney, to look after the maritime interests of the principal Powers, leaving the company in London free to care for its own enormous interests in the British Mercantile Marine.

"In addition to these offices, inspection and repair depots have been opened at all important sea ports throughout the world, where vessels carrying wireless can have their plants inspected and repaired if necessary.

"The object of our companies forming this international organization is to carry on the work they have begun in conjunction with the different governments, to render it more efficient still and to apply their experience and immediate contact with the maritime communication, to the solution of problems which are confronting us now and those likely to arise in the future.

"The conduct of ocean telegraphy in the hands of one international organization has rendered possible the development of a newspaper enterprise on board ship on efficient and economic lines. On numerous liners now a daily paper is published, containing the latest news from all over the world, received from powerful transmitting stations on each side of the Atlantic.

"Obviously, a service of this kind can be run more cheaply for a large number of vessels than for a few.

"Apart from that, the cost of erecting and working a high-power station purely and simply for one line of steamers, in addition to the cost of compiling the news and forwarding it, would make the charge to the shipping company prohibitive."

Association of Sign Manufacturers to be Formed.

A call has been issued by *Signs of the Times* for a meeting of electric sign manufacturers to be held at the La Salle Hotel, Chicago, Ill., on Monday, December 1, at 10 a. m., to organize an association of electric sign manufacturers.

The Use of Electricity in Irrigation for Intensive Farming.

By D. R. Palmquist.

Of all the varied industries and means of producing wealth, there is none which ever has or probably ever will compare in importance with agriculture. The value of our farm products is far in excess of the value of those from any other source, and is of inestimably greater benefit to the world. The principal elements affecting the growth of plant life consist of the soil, climate, cultivation and the amount of moisture in the ground; and the best results are obtained only from a proper combination of the same.

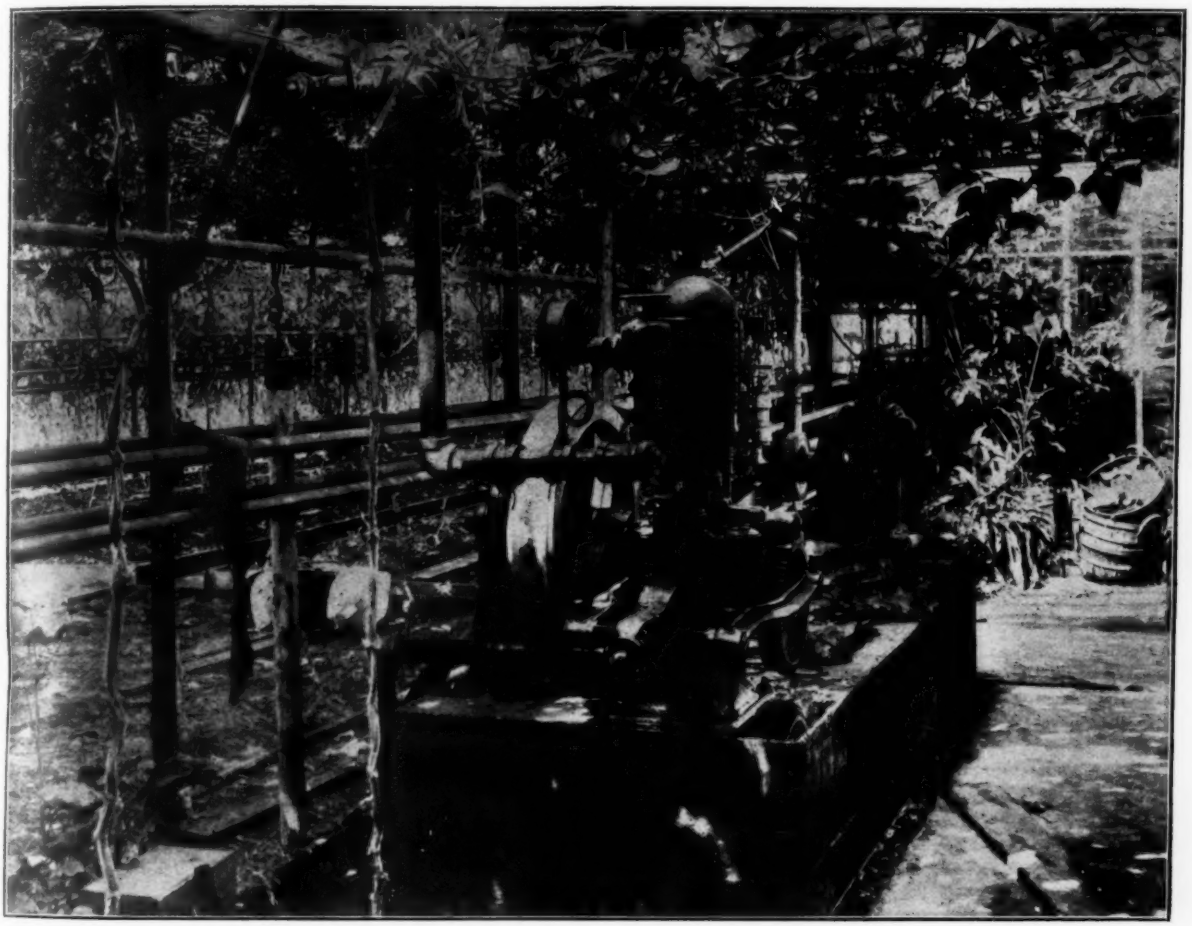
In much of the country the soil and climate are suitable for the growth of crops of various kinds, and cultivation is entirely under control of the farmer, but the amount of moisture in the ground is such as to preclude successful farming in certain areas, owing to too small a water supply. The proper amount of moisture may be artificially retained in the soil by supplying it by irrigation.

The United States may be divided into three zones, according to the annual rainfall: the humid zone, where the rainfall is over 30 inches per year; the semi-humid zone, where the rainfall varies between 20 and 30 inches per year; and the arid zone, where the rainfall is less than 20 inches per year.

The arid zone is situated mainly in the western half of the country, while the humid zone lies to the east; and intermediate between them is the semi-humid zone, the line of division between which and the other zones is not sharp. This zone includes, in general, North and South Dakota, western Nebraska, western Kansas, Oklahoma and the Panhandle and part of central Texas.

It is the purpose of this article to deal only with irrigation in the humid and semi-humid sections and to point out to central stations the vast possibilities of increasing their day load, by suplying power for irrigation pumping.

A good many people look upon irrigation, except where its use has been absolutely necessary in the arid regions of the West, merely as an insurance against the loss caused by a possible drought; in other words, a way of saving money, not of making it. It is this fact more than any other which accounts for the comparative slowness with which Eastern growers have adopted it. As a matter of fact, however, abundance of water—all the plant can use, not merely enough to enable it to mature—is just as essential to the production of big crops as are ample fertilizing and adequate cultivation. It is just as short-sighted to



Pump Supplying Water for Twelve Large Greenhouses from a Well 600 Feet Distant.—Driven by Five-Horsepower Induction Motor.

begrudge the expense for this item as for the last two. Instances are plenty in which even in normally wet seasons irrigated crops have been from 50 to 100 per cent larger than those grown beside them that received only the natural rainfall.

Of all the various enemies of farmers' and gardeners' crops—bugs, maggots, scale, fungous diseases, **lack of** water, and so on—the most serious and the most insidious is lack of water, whether it gets to the degree of drought or not. And the worst feature about it is that most growers have come to accept it as an inevitable part of agricultural occupations. They will fight desperately against everything else, but when the "dry spell" comes they just give up and accept the inevitable, or, at best, resort to the soil mulch that is furnished by frequent cultivation—a practice that is of great value, but cannot possibly add a drop of water to the supply in the soil. It may prevent a crop failure, but it cannot guarantee maximum crops. The production of maximum crops, not once in every three years or five years, but every year, is the ultimate problem of the grower who is determined to make something more than a bare living out of his profession.

The growth of plants requires a certain amount of moisture in the soil to feed the nutriment therefrom to the roots of the plants. Either too much or too little moisture is detrimental to plant growth, and efficient irrigation consists in supplying the requisite amount of moisture to the soil. However, a fairly wide range of percentage of moisture in the soil will in general give satisfactory results. When the soil contains about 20 per cent of saturation water, it is dry to all appearances, and is not suitable for plant growth.

In the case of garden truck, where the values of crops are very large, irrigation, even though very expensive, will pay for itself many times over. Crops of this nature are more sensitive to moisture requirements than more deep-rooted crops, and frequently a drought of a few weeks may result in the total failure of the crop. The increased yield of irrigated crops and the finer product often pay for themselves even in good years. Irrigation will also make the crop mature earlier, when better prices may be obtained, and will frequently allow the growth of one crop per season more than can be grown on unirrigated land.

Furthermore, the moisture required for plant growth will vary with the condition of the crop. For example, crops such as onions, strawberries, etc., require moisture especially during the time the bulbs and the berries are maturing. Climatic conditions largely affect the irrigation requirements. It is not sufficient that the total rainfall be up to a certain quantity, but the distribution thereof should also be such as to insure the proper moisture in the ground during the growing season. Then, too, most crops that are grown on truck farms are composed of approximately 95 per cent of water. If this large amount of water is not available at the proper time, a small and inferior crop will result.

Frequency and Length of Periods of Drought.

In humid and semi-humid regions it is the frequent recurrence of periods of small or no rainfall, especially if they occur at the time when the crop is approaching or has reached the fruiting stage, that, more than anything else, makes supplementary irrigation indispensable, if large yields are to be realized.

To show just why it is that in humid sections the irrigation of crops does produce a very marked increase in the yield, the agricultural college at the University of Wisconsin made a study of the distribution of the rainfall at Madison, Wis., for the years 1887 to 1897, inclusive. The results are here given in a condensed form as an illustration of the type of rainfall conditions under which, in a humid climate, it may be desirable to irrigate.

"It is generally true that a rain of 0.05 or even 0.1 inch, when it comes alone, separated by two or three days from any other rain, benefits ordinary

Two-Horsepower Motor Driving Pump to Supply Large Greenhouses and Outside Truck Garden.

TABLE I.—NUMBER OF PERIODS AND MEAN LENGTH OF THESE PERIODS IN EACH YEAR, WHEN THE AMOUNT OF RAIN IS NOT GREATER THAN THAT GIVEN AT THE HEAD OF THE RESPECTIVE COLUMNS.

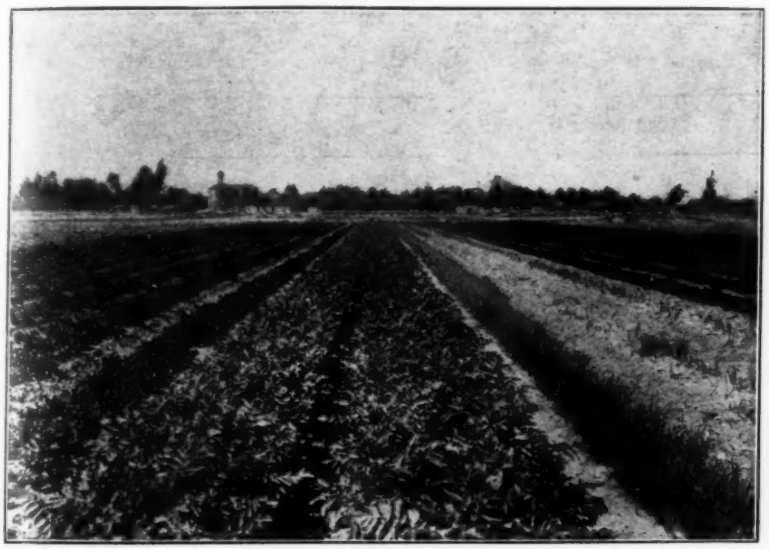
YEAR.	Rainfall 0.05		Rainfall 0.1		Rainfall 0.5		Rainfall 1		Rainfall 1.5		Rainfall 2		Rainfall 2.5	
	Number of Periods in Each Year.	Mean Number of Days in Each Period.	Number of Periods in Each Year.	Mean Number of Days in Each Period.	Number of Periods in Each Year.	Mean Number of Days in Each Period.	Number of Periods in Each Year.	Mean Number of Days in Each Period.	Number of Periods in Each Year.	Mean Number of Days in Each Period.	Number of Periods in Each Year.	Mean Number of Days in Each Period.	Number of Periods in Each Year.	Mean Number of Days in Each Period.
1887	20	7	22	6	18	9	12	13	11	14	10	18	8	24
1888	27	5	25	6	22	8	15	12	11	15	8	21	6	31
1889	21	7	20	7	16	11	13	15	10	18	7	26	6	31
1890	28	4	23	6	20	8	17	10	16	10	14	13	12	15
1891	20	8	20	8	15	12	11	15	8	22	7	26	5	36
1892	22	5	25	5	22	7	20	9	19	9	15	12	13	15
1893	22	6	22	6	20	9	18	9	14	13	12	15	10	18
1894	20	7	18	7	16	9	15	12	13	14	9	14	9	20
1895	21	6	22	7	13	14	9	20	5	37	5	39	4	44
1896	27	4	27	5	27	6	26	7	19	10	15	12	11	17
1897	28	5	28	5	19	9	15	13	11	17	8	23	6	31
Average length of each period....		5.82		6.18		9.27		12.27		16.27		19.91		25.63
Average number of periods...	23.27		23.09		18.91		15.55		12.45		10		8.17	

farm crops but little; but in order that we shall not undervalue the rain which falls, we have included everything, large and small alike, and have constructed Table I for these years, 1887 to 1897, which shows the length and number of periods in each year between April 1 and September 30, when there were consecutive days having a rainfall whose sum did not exceed 0.05, 0.1, 0.5, 1.5, 2 and 2.5 inches.

"Studying this table, it will be seen that during the eleven years there have been on the average in the growing season 23 periods of 5.82 days when the rainfall has not exceeded 0.05 inch; there have been 23 periods 6 days long with a rainfall of 0.1 inch; 19 periods on the average 9 days long with a rainfall of 0.5 inch; 15 periods each year 12 days long, with 1 inch; 12 periods 16 days each, with but 1.5 inches; 10 periods each season 19 days long, with 2 inches; and 8 periods each season of 25 days each, when the mean rainfall did not exceed 2.5 inches."

The small average yields, reported from so many states, and agreeing so closely one with another, must be looked upon as expressing conditions unfavorable to large yields, and conditions which the best of management cannot hope wholly to counteract.

The facts are that we are here confronted with results which are due, in a very large measure, to the long intervals between effective rains, to which reference has already been made. This uneven distribution is so general in its character that when the yields over wide areas are brought together for comparison, the small yields due to faulty distribution of rain so far outweigh the large yields, where the amount of moisture has been just right, that small averages are inevitable. Nor is this condition of things strange, for, since the rainfall is in no way controlled by any factor operating to cause precipitation, either when it is wanted or in the amount which the particular crop on the particular soil may at that time need, it cannot be expected that such a régime of chance would on the average develop the conditions most favorable to large crops.



An Irrigated Truck Garden.

In the year book of the Department of Agriculture for 1911, Milo B. Williams, in charge of irrigation investigations in the humid region, says: "In a majority of years nearly all sections of the humid region are visited by one or more dry periods of sufficient length to damage crops, especially truck and berries and other small fruit. The normal annual precipitation of Columbia, S. C., is 47.55 inches, yet in 10 growing seasons, from 1900 to 1909, inclusive, 62 droughts occurred in this vicinity. Twenty-seven of these lasted between 20 and 30 days, six between 40 and 50 days and one had a duration of 61 days. When one assumes that water may be advantageously applied when less than one inch of rain falls in a 15-day period there would then be, on an average, 56 days during each growing season when irrigation water might be beneficially applied to this part of South Carolina.

"The annual rainfall for Minnesota, Wisconsin and Michigan ranges between 30 and 45 inches. Assuming these states to have a growing season extending from the first day of April to the last day of September, Oshkosh, Wis., experienced in 10 growing seasons 27 droughts having duration of 15 days or over, when less than one inch of rain fell. Sixteen of these dry spells came in the spring and early summer, one of which lasted 59 days." Investigations in other Eastern States have shown that droughts occur in all localities and that the above are about average conditions.

Curve I in Fig. 4, shows very clearly the irregular and inadequate distribution of the natural rainfall in the vicinity of Chicago, during 1911, to grow a maximum crop of potatoes, although the mean annual rainfall is quite large at that place. It will be noticed from this curve that practically no rain fell from July 3 to July 10, a period very critical in the growth of potatoes, as they were "in bloom" and required a large amount of water at that particular time. If the natural rainfall had been supplemented by irrigation at this place at least twice the yield of potatoes would have resulted.

Furthermore, in the growing of potatoes, it is a matter of the greatest importance that the ground shall be kept well moistened continuously after the tubers have begun to form, so that they shall be kept steadily growing. If the ground is allowed to become dry enough to check their growth and another rain follows, the tubers will then throw out new growths and become irregular in form and unsalable.

TABLE II.—DIFFERENCES IN YIELDS PER ACRE WHEN THE NATURAL RAINFALL IN WISCONSIN IS SUPPLEMENTED BY IRRIGATION.

These figures show very clearly the insufficiency of rain these four years to produce the largest possible yields.

YEAR.	Corn.		Potatoes.		Strawberries.		Cabbage.		Barley.		Clover.	
	Irrigated.	Not Irrigated.	Irrigated.	Not Irrigated.	Irrigated.	Not Irrigated.	Irrigated.	Not Irrigated.	Irrigated.	Not Irrigated.	Irrigated.	Not Irrigated.
	Tons.		Bushels.		Boxes.		Tons.		Bushels.		Tons.	
1894	5.176	3.835			6,867	3,496						
1895	5.293	1.384			8,732	1,030			51	25	4.01	1.45
1896	5.15	4.145	394.2	290.5			22.79	20.04			3.632	2.254
1897	4.252	3.405	333.9	212.3					45.67	44.25	4.434	2.482

Results of Irrigation.

The value of irrigation in humid and semi-humid sections depends on the crops, the seasons, and the distance to market. For truck, it is not uncommon for irrigation to be worth from $100 to $300 per acre, and in some cases as high as $1,500.

Tables II, III, IV and V are taken from King's "Irrigation and Drainage," and show the results of supplementary irrigation in Wisconsin. In

TABLE III.—DATA ON THE IRRIGATION OF POTATOES.

The amounts of rainfall and of water applied by irrigation are given.

Rainfall in Inches. First year.	Second year.	Water of Irrigation. First year.		Second year.	
May 6.11	.51	July 10	2.15		
June 2.25	4.03	July 21	2.15	July 20	2.45
July 3.42	1.79	Aug. 3	2.15		
Aug. 2.43	3.7	Aug. 10	2.15	Aug. 18	2.45
Sept. 3.73	1.73	Sept. 3	2.15	Sept. 8	2.45
Total 17.94	11.76		10.75		7.35

TABLE IV.—YIELD IN BUSHELS PER ACRE OF POTATOES IRRIGATED AND NOT IRRIGATED IN WISCONSIN.

	Irrigated. Large.	Small.	Not Irrigated. Large.	Small.
RURAL NEW YORKER.				
First year	382	12.3	280.3	10.2
Second year	365.8	9.1	239.6	9.7
BURBANK TYPE.				
First year	220	22.7	141.5	16.2
Second year	302	16.8	184.9	19.75
Mean	317.5	15.2	211.6	14
Difference	105.9	1.2		

Table III it will be seen that in the first year the irrigated potatoes had 10.75 inches, and in the second year 7.35 inches more water than the potatoes grown under the natural rainfall conditions. These differences in the amount of water produced differences of yields, which are shown in Table IV.

The amount of water given to this crop in the first year was 10.75 inches, in five applications, July 10 and 21, August 3 and 10, and September 3, 2.15 inches being applied each time. There is a difference of 105.9 bushels of merchantable tubers per acre, as an average of two years, in favor of the larger water supply.

In the work with cabbage the results were equally as good. The weight of the heads dressed for market is given per acre in Table V.

To show the value of irrigation in the semi-humid zone, comparative tests were made on irrigated and non-irrigated land at Beeville, Tex., by G. K. Robertson, superintendent of the State Experiment Station. In the crop of onions, irrigation increased the net profit per acre by $350, while the net profit per acre for cabbage was increased by $222.

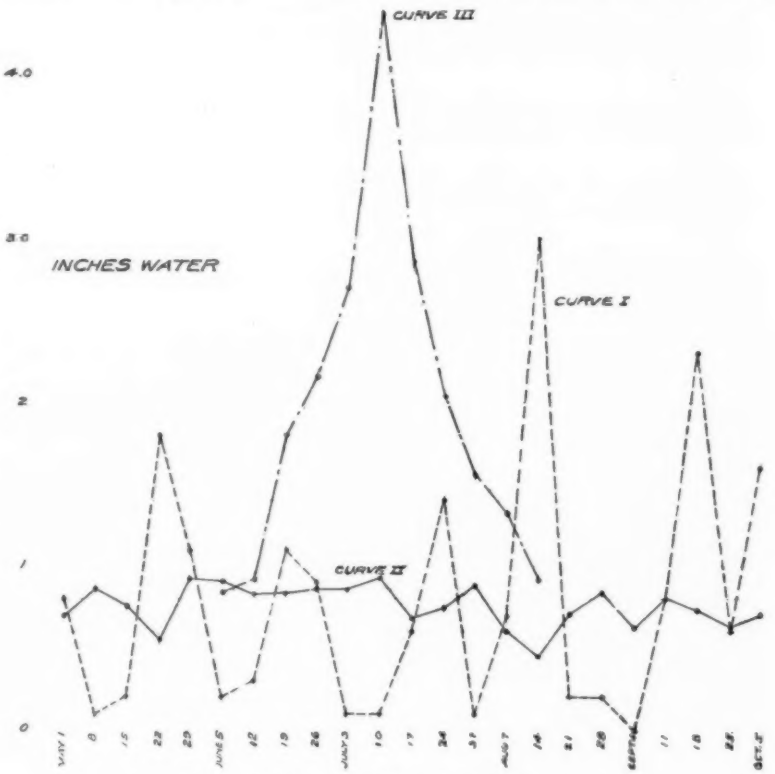
Systems of Irrigation in Humid Regions.

Surface irrigation is most generally used in the Western States, but cannot be so readily adapted in the humid regions. It is often impracticable to change regular shaped fields and long rows to irregular ones conforming to the typography of the land. In many cases it is impossible to grade lands having a shallow soil without destroying the productiveness of a large part of the surface. There are also many valuable crops that are grown too thickly on the surface of the ground to permit the running of water between the plants. Notwithstanding these objections there are many fields in humid regions that can be economically irrigated by flooding the surface. Cultivated row crops in such fields can be irrigated by running water between the rows.

Many areas in humid regions are adapted for sub-surface irrigation through underground tile or pipe. Sub-irrigation requires level lands having a shallow, porous surface soil overlying an impervious substratum. Only shallow-rooted crops can be grown without danger of stopping up the tile. Sub-irrigation is usually not practical except for crops that will pay interest on a system costing $100 or more per acre.

The system which has greatest possibilities for applying water in humid regions is distributing it through the fields under pressure in pipes which will spray it into the air and let the moisture fall like a gentle rain, or what is sometimes called the aerial method.

The basic principle of this system of irrigation is that water under pressure, when forced through a small aperture, may easily be thrown a considerable distance, and, furthermore, will tend to be broken up into a spray by the resistance of the air. The inventor, Mr. Skinner, has used great ingenuity in devising a means of bringing this fact into practical and economical use. In this overhead system water under pressure from 30 to 60 pounds is forced through nozzles with openings of a small fraction of an inch to a distance of from 20 to 30 feet. These jets of water which are forced out as solid streams, break up into drops resembling a fine rain before they fall. The nozzles are inserted in a feed pipe, termed the "nozzle line," every four feet, as at that distance they are found to cover the ground thoroughly. The nozzle lines are placed from 40 to 60 feet apart, according to the water pressure, and are so supported that they may be revolved about their axes by a handle, thus directing the spray so that it will fall on either side of or under the nozzle line. In operation



Curve I—Actual Rainfall at Chicago in 1911.
Curve II—Normal Rainfall at Same Place.
Curve III—Water Required for Maximum Crop of Potatoes.

TABLE V.—YIELD OF CABBAGE IN POUNDS PER ACRE.

	THIN PLANTING. Irrigated.	Not Irrigated.	Difference.	THICK PLANTING. Irrigated.	Not Irrigated.	Difference.
Firm heads	30,610	29,480	1,130	46,590	40,100	6,490
Loose heads	6,227	4,624	1,603	7,688	5,943	1,745
Total	36,837	34,104	2,733	54,278	46,043	8,235
Leaves and stumps	42,730	39,220	3,510	64,100	57,630	6,470
Grand total	79,567	73,324	6,243	118,378	103,673	14,705

the nozzle line is revolved a few degrees every half hour or so, according to the water pressure and the degree of soaking desired, so that the whole field may be evenly wet. The nozzle line is turned easily by a short handle inserted in a patented union, which not only prevents leakage, but strains the water going into the pipes and allows for the flushing out of the main line and strainers by simply unscrewing a cap at the end of the handle.

The overhead system of irrigation described has several advantages over the other systems. There is no labor in applying the water; the distribution is practically perfect; no injury is done to crops or soil; after cultivation is not necessary. It is also used as a protection against light frosts.

Wells and Pumps.

Unlike the case of machinery for pumping, it is impossible to give an approximate figure on the cost of boring or sinking wells, unless the nature of the strata encountered be known.

The best form of well is the dry well, where the sides, if necessary, are curbed with wood or masonry, to prevent caving of the earth. These wells are comparatively shallow.

The drive well consists of a pipe, on the end section of which is a strainer. The extreme end of the pipe is covered by a taper point which facilitates driving the pipe into the ground. These wells are usually not deep, on account of the difficulty of driving the pipe. The form of well most extensively used in irrigation is the bored well. A circular hole is bored in the ground by various means and, if the strata encountered are liable to cave, it is cased off by iron casing. Bored wells render practical the matter of sinking to great depths.

For pumping plants of any size, the centrifugal is generally the most desirable pump to install. It has the combination of cheapness, simplicity, and a minimum of working parts. It has no valves to give trouble, and can handle water with grit without getting out of order, though, of course, the wear is increased in that case. The improvements in the centrifugal pump have contributed largely to the increase in irrigation pumping. Good results as regards efficiency may be obtained by the proper use of these pumps as now constructed by the leading manufacturers.

Electric Power for Irrigation.

Electricity is the best source of power for irrigation pumping, since no attention is required at the pump. In the case of steam, gasolene, or producer gas, it is necessary to have a man in constant attendance, but if the pump is direct-connected to a motor, the only attendance necessary is the starting and stopping. Furthermore, the initial cost, maintenance and repairs are much less for an electrically operated plant than for a gasolene plant.

In the vicinity of Rochester, N. Y., electric power is used for irrigation to a great extent by the farmers. The Rochester Railway and Light Company has at the present time nearly 100 motors installed on the various farms in that vicinity for the purpose of pumping water for irrigation. Electric power is obtained from the high-voltage, three-phase transmission lines, which the company runs out into the country to supply the farmers.

The overhead system of irrigation described in the foregoing is used almost entirely in this vicinity. Electricity is also used to light the houses and barns and to operate motors for the various farm machines. This enables the company to get a constant revenue from these installations.

Before the advent of electricity, the farmers used their windmills to pump water, but they found them very inadequate for their purposes, and oftentimes the windmills failed them completely at critical times, when water was needed badly by the crops.

Many other central stations throughout the country are commencing to realize the possibilities of this new outlet for their power and are extending their lines into the rural districts.

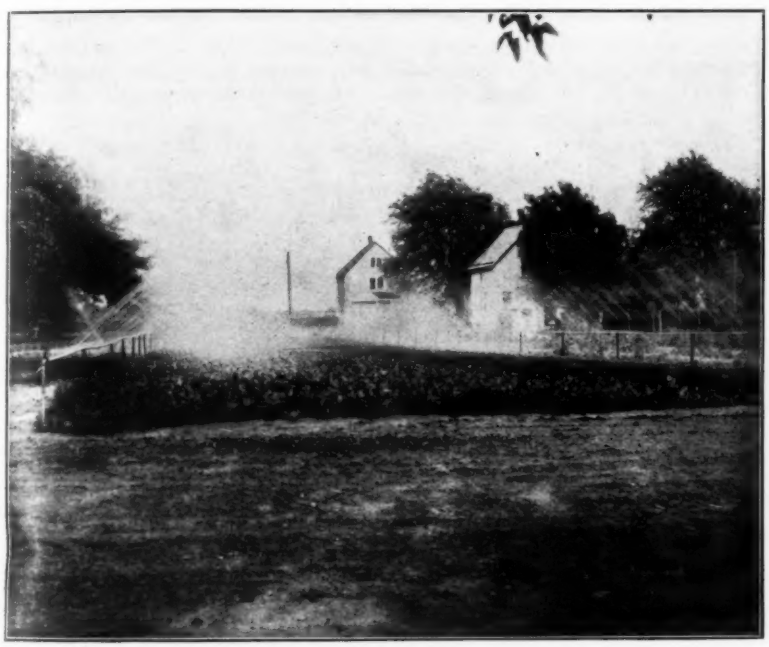
Conclusion.

Surrounding all cities of any size at all, are large areas devoted to truck gardening and other intensive farming. The lack of water is the worst enemy with which these farmers have to contend, and any method of overcoming this enemy will be greeted with open arms by them.

Furthermore, if a systematic study be made of the other power requirements, besides irrigation, on these farms, it will be surprising to learn the large number of machines for which mechanical or electrical power is required to operate. As an illustration, last year one of the leading manufacturers of gasolene engines, alone, sold nearly 50,000 engines to farmers. This proves conclusively that the farm offers big opportunities for electrical development and the outlet of central-station power.

The farmer of today is not the farmer of yesterday, nor will the farmer of today be the farmer of tomorrow. Every day sees new business principles and methods introduced into the business of farming and the time is not far distant when the farmer will consider the use of electricity for light and power as indispensable in his work as the manufacturer.

The illustrations in this article are published by courtesy of the General Electric Company.



Sprinkling System of Irrigation Applied to Market Garden.

Bangor Dam Completed.

The new dam of the Bangor Power Company at Veazie, Me., has been completed. It is located on the Penobscot River and will add 1,000 horsepower to the capacity of the plant, making a total of 18,700 horsepower.

Commercial Practice
Management, Rates, New Business

Cost of Pumping by Electricity.

We are indebted to R. A. McNally, commercial engineer with the Northern California Power Company, for the table below, showing the cost of pumping water by means of electric motors for different heads and different rates for electric energy.

In computing this highly valuable table it has been assumed that losses in pump and motor are 60 per cent, or in other words that the plant efficiency is 40 per cent. The column designated as "Total Head" shows the difference in the level of water in the well and the surface of the water where it is discharged.

The number of gallons necessary to cover one acre three inches deep is 81,675 and the table is based upon this quantity.

In addition to the element of cost, when comparing an electric motor with a gasoline engine, it should be emphasized that the motor through its flexibility can be adapted to a great many different purposes upon the farm requiring mechanical power and need not necessarily be restricted to its use in driving a pump.

COST IN DOLLARS OF PUMPING WATER TO COVER ONE ACRE THREE INCHES DEEP.

Total Head, in Feet.	Rate Per Kilowatt-Hour in Cents.								
	1	1.5	2	2.5	3	3.5	4	4.5	5
10	0.064	0.096	0.128	0.160	0.192	0.224	0.256	0.288	0.320
15	0.096	0.144	0.192	0.240	0.288	0.336	0.384	0.432	0.480
20	0.128	0.192	0.256	0.320	0.385	0.448	0.512	0.576	0.640
25	0.160	0.240	0.320	0.400	0.481	0.560	0.640	0.720	0.800
30	0.192	0.288	0.385	0.481	0.577	0.673	0.768	0.864	0.960
35	0.224	0.336	0.449	0.561	0.673	0.785	0.896	1.010	1.122
40	0.256	0.384	0.513	0.640	0.769	0.897	1.024	1.153	1.280
45	0.288	0.432	0.577	0.720	0.865	1.009	1.152	1.298	1.442
50	0.320	0.480	0.641	0.800	0.960	1.121	1.282	1.442	1.600
55	0.352	0.529	0.705	0.881	1.056	1.234	1.408	1.586	1.760
60	0.384	0.576	0.769	0.960	1.152	1.346	1.536	1.728	1.920

Kentucky Section to be Organized.

A meeting of the officials of the new-business departments of various Kentucky companies was held at the Tyler Hotel, Louisville, Ky., on November 7. The meeting was called by the Federal Sign System (Electric) and R. E. Brian, manager of the Louisville office, presided. Plans for establishing a Kentucky section of the National Electric Light Association were discussed. Similar luncheon meetings will probably be held monthly.

Large Order for Electric Trucks.

The New York Railways Company, successor to the Interborough Rapid Transit Company, has placed an order amounting to about $100,000 for electric vehicles to supplant its present horse-drawn wagon service.

The order calls for the following machines: One 1,000-pound wagon with express-type body; two 1,000-pound wagons with panel bodies; one 2,000-pound panel money wagon; fourteen 7,000-pound trucks with steel dumping bodies with hand-operated dumping devices; four 3.5-ton trucks with platform and stake bodies; one 5-ton truck with stake platform, and one 5-ton special truck.

Motor Drive for Mine Pumps.

The use of electric motors for driving mine pumps has become quite common and offers under most circumstances the most satisfactory form of drive for this work. It also constitutes a very desirable load for the central station on account of the long hours of use and consequently high load-factor. The accompanying illustrations portray installations of this kind which have given satisfactory service.

Fig. 1 represents two Deane horizontal triplex double-plunger pot-valve mine pumps installed by the Golden Cycle Mining Company at Colorado Springs, Colo. The piston dimensions are 4.5 inches by 12 inches. The head in this case is 1,650 feet and the capacity 300 gallons per minute. The pump is connected through herringbone gears and a flexible coupling to a 2,200-volt, 175-horsepower General Electric motor running at 600 revolutions per minute. These pumps showed an efficiency of over 87 per cent at the purchaser's official test. Such a figure insures a low consumption of power in operation and constitutes an important item in the selection of a machine.

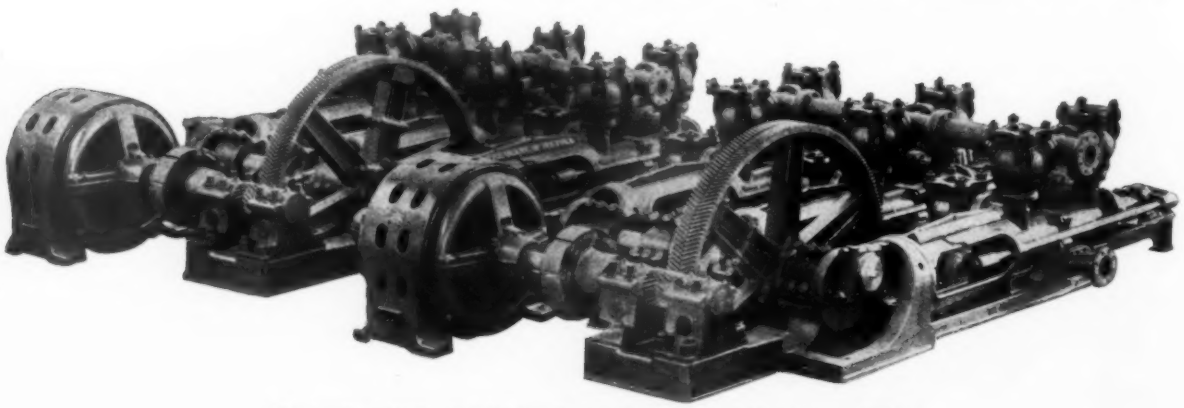


Fig. 1.—Two Horizontal Triplex Pumps Driven by 175-Horsepower Motors.

Fig. 2 represents a pump installed by the Delaware & Hudson Company, which is particularly suited to coal-mine service, as the pump end can readily be fitted with a wood lining to prevent the corrosive action of the water upon the metal Seven of these pumps, having a piston dimension of 12 inches by 12 inches, have been installed by this company on repeat orders, indicating that the operation has been entirely satisfactory. The working

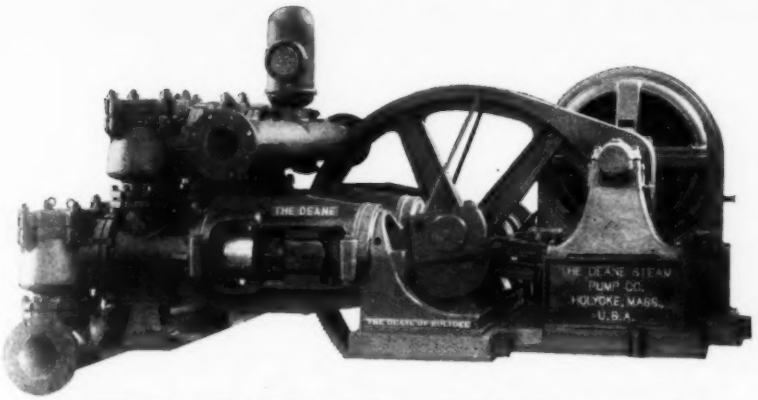


Fig. 2.—Horizontal Single-Acting Mine Pump Driven by 125-Horsepower Motor.

parts which are subject to the destructive action of the water may be made of acid-resisting bronze if desired. These pumps are also driven through herringbone gears by a 125-horsepower motor running at 375 revolutions per minute on a 440-volt circuit. The capacity of the pump is 875 gallons per minute on a 400-foot head. The pump speed is 48 revolutions per minute.

Fig. 3 represents a form of mounting which is recommended where there is a possibility of partial flooding of the pump room. This pump, which is located in a Colorado mine, will operate satisfactorily even though the pump proper be submerged. This construction also economizes floor space. This is a single-acting triplex pump with a cylinder five inches by eight inches. It pumps 135 gallons per minute under a head of 900 feet. The pump speed is 58 revolutions per minute.

The Edison Electric Illuminating Company of Boston is about to open an office and display room on Beacon Street, Coolidge Corner, in the fashionable part of Brookline, Mass.

The municipal authorities of Glasgow, Scotland, are considering the construction of electric subway lines or "tube railways" across the city from east to west in order to relieve the rapidly increasing congestion.

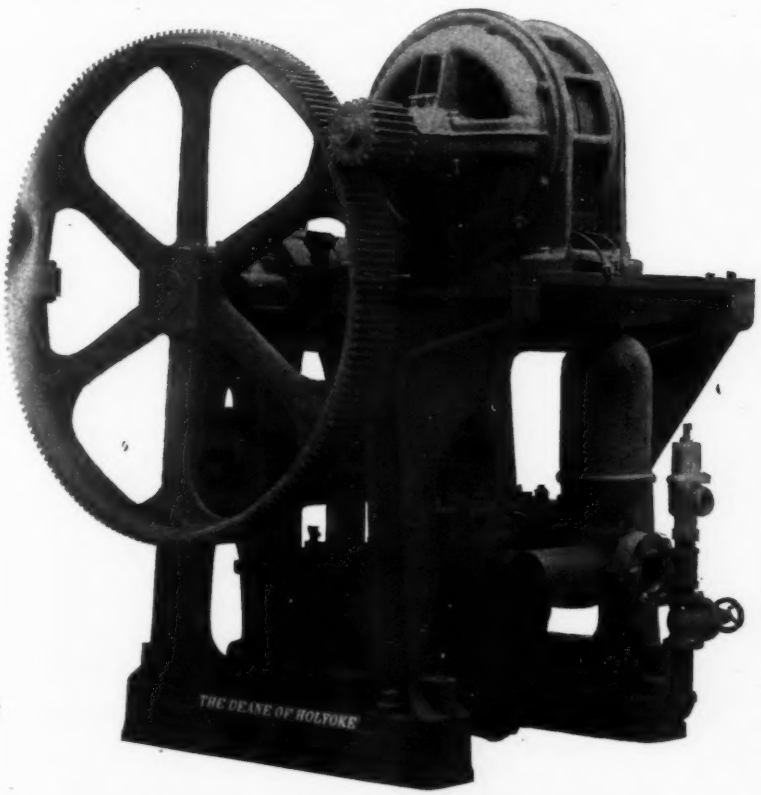


Fig. 3.—Vertical Single-Acting Triplex Motor-Driven Pump.

Twenty-two Reasons for Using Central-Station Power.

The Merchants Heat & Light Company, of Indianapolis, Ind, has since the first of the year been publishing a clever monthly called *The Twin-Stack News*, this name being appropriately derived from its main generating plant. This paper contains from 16 to 20 pages, about 9 by 12 inches, containing not only news about the company's business of interest to its patrons or prospects, but also many articles that are bound to develop the good will of the public and to increase the demand for light, heat and power.

In a recent number there were given in uniquely condensed form 22 reasons for using central-station power, that are reproduced below:

1. Smaller investment; no capital tied up in generating apparatus, fuel, supplies, etc.
2. Reliability of supply; failure almost unknown.
3. Any accident to a machine is confined to that particular machine and does not affect any other portion of the shop. In all other systems the machines are not thus independent.
4. Availability of supply at any moment, day or night, and the cost for power always in proportion to amount of work being done.
5. Ample overload capacity.
6. No delay from lack of power; power always ready.
7. Good voltage regulation; lights steady and motor speeds constant.
8. Freedom to locate factory anywhere within several miles of central station and to relocate at any time without reference to power supply.
9. Ability to enlarge factory capacity at any time in order to keep pace with demands, without expensive changes in power plant.
10. Freedom from repair bills chargeable to power plant.
11. Freedom from all expense and annoyance chargeable to operation of power plant; this includes labor troubles, fuel shortage, breakdowns, etc.
12. Decreased hazard from fire and explosion owing to absence of boiler house.
13. Decreased insurance rates, owing to decreased hazard.
14. Absence of all noise, vibration, heat, smoke, dirt, etc., which would come from a power plant in the factory building or in close proximity to it.
15. Additional productive capacity of employees, due to cleanliness, comfort and good ventilation, which are not always possible when a power plant is near by.
16. The cessation of all expense for power as soon as machine stops operating. With a private plant, many charges are continuous.
17. Ability to work overtime with pow-

er charge only in proportion to the work done.

18. Decreased office expense; no bookkeeping or clerical work on account of power.

19. Ability to sell fuel refuse, if any is produced, for enough to cover a large part of the power bill.

20. Ability of the manager to devote all of his time to the requirements of the factory, whereas the problems of the power plant would require a considerable portion of his attention.

21. Ability to compare cost of power, month by month, with output, and to detect and check needless waste of power. The cost of power from a central station is in a simple monthly bill which comes to the manager's attention, while the isolated plant costs are spread through many bills and do not, in the aggregate, come to the attention of the manager.

22. The experience of others has always proved favorable to the use of central-station power.

Central-Station Progress at Minneapolis.

At the invitation of General Manager Pack of the Minneapolis General Electric Company, the mayor and other officials of that city inspected the Coon Rapids hydroelectric development now under construction by H. M. Byllesby & Company, on the Mississippi River near the town of Anoka, Minn. The visitors were surprised at the magnitude of the work and the progress made and praised the modern methods employed for housing and caring for the large construction force.

The necessity for this additonal waterpower is shown by the greatly increased business of the Minneapolis General Electric Company, which on October 14 made a new high record in electrical output. On that day 347,930 kilowatt-hours of energy were transmitted to customers. Much additional business is being signed, one of the large new contracts covering a 300-horsepower installation for the Minneapolis Battery Company.

San Diego's Electric Sign.

A permit has been issued by the San Diego Building Department for the erection of what, it is said, will be the largest electric sign in southern California. The sign, which will contain 32,000 lamps, will be 48 feet high and will be located on the roof of the Josse Building. It will cost $10,000. Across the top in large letters will appear the slogan: "San Diego, First Port of Call." The lower half of the sign will be devoted to revolving electric signs of business firms. Current will be furnished by the San Diego Consolidated Gas & Electric Company.

Commonwealth Edison Contract Department Discusses Electric Vehicles.

The contract department of the Commonwealth Edison Company held a very interesting meeting on the evening of Tuesday, November 11, when R. Macrae, of the company's storage-battery and electric-vehicle department, delivered an address on the electric-vehicle situation in Chicago. Mr. Macrae pointed out in very simple language the change that had come about in public opinion with respect to the utility of the electric vehicle and indicated to the salesmen who were present some of the features which it was necessary to be well grounded in in order that the electric vehicle might be properly understood. Mr. Macrae pointed out that favorable conditions were needed in order to get the best results from any piece of apparatus. He was of the opinion that the claim had been made so persistently that an electric vehicle requires no special attention and that anyone can operate it anywhere, made it difficult to convince the public that conditions have anything to do with the performance of an electric vehicle. The idea he wanted to impress was that it was not true that anyone can operate an electric vehicle, and that the conditions that are all right for a horse-drawn vehicle are also all right for an electric vehicle. He emphasized the fact that an electric vehicle requires very special attention, which must be given to it by a person who not only knows what to do, but also has the facilities for doing it. When this is properly understood more attention will be given to garaging, and when garaging facilities are available such as are proper and adequate for the handling of electric vehicles, the matter of securing business will be made very much easier.

With the assistance of some excellent lantern slides, Mr. Macrae showed how the bulk of the demand for the charging of storage batteries in electric vehicles in both private and public garages came in the natural valleys of the central-station load, and indicated how essentially justifiable a proposition the differential rate became under these circumstances. The number of electric vehicles has increased about 700 in the last three years in Chicago. One commercial house that took the first two years to determine upon the use of their first 24 vehicles, boosted it to 152 within the last 18 months. One garage in Chicago has a maximum demand of 38,160 kilowatt-hours, and four public garages have a maximum demand of over 30,000 kilowatt-hours. He also showed some interesting figures which had been compiled by the Commonwealth Edison Company taking into consideration all of the known costs of electric vehicles against horse trucking. Charging a rate of four cents a kilowatt-hour, which the outside user could obtain for two cents, the cost of electric-vehicle transportation was 25.1 cents per mile per month, on a basis of 15 miles per day, and 25.5 cents per month. The cost of horse-drawn transportation was 32.1 cents per mile under the same conditions. An interesting figure brought out was that the average truck man, or man operating a delivery service, could operate two electric trucks at the cost for energy as would be required for the shoeing of two horses.

In discussing the use of the mercury-arc rectifier, Mr. Macrae stated unequivocally that the arc rectifier gave excellent service in garages of every description. Where the mercury-arc rectifier did not operate satisfactorily it was not due to any inherent defect in mechanical design, but rather to the abuse which the garage attendants subjected it to. In this event, however, the tube was actually one of the greatest safeguards that the electric-vehicle man possessed. In case of anything going wrong on the line the tube would not operate, thus presenting an effectual barrier for heavy charging currents and other disturbances that might affect the life and performance of the storage battery and other equipment. Incidentally, the tube would give a service of from three to four years under ordinary conditions without replacement, and in his experience, which had extended over a considerable period, he had found absolutely no fault with the arc-rectifier system.

The meeting was conducted by E. W. Lloyd, manager of the contract department of the Commonwealth Edison Company, who closed the discussion after elucidating several points in connection with the differential that is properly earned by the user of large amounts of energy who stays off the peak and contributes to the improvement of the load factor of the system and therefore to the relief and improvement of the service for every individual connected to the system.

Hydroelectric Plant in England.

Owing to the flat nature of the country there has been little hydroelectric development in England. A power plant was recently put in operation at Chester, however, which makes use of power from the River Dee. The plant comprises three vertical-shaft Francis-type turbines, designed to work under a head varying from one to nine feet. Two of the turbines have a capacity of 415 horsepower at 50 revolutions per minute, while the third has a capacity of 305 horsepower at 55 revolutions per minute. The generators are of the shunt-wound interpolar type.

This plant is of especial interest owing to the fact that it is located upon tide water and the available head will vary daily with the ebb and flow of the tide. It was formally opened on October 20.

Electrical Construction

THE ELECTRICAL WORK IN A MODERN RESIDENCE.

Notes on Equipment and Installation.

Six or seven years ago the use of electricity in the home for any other purposes than the lighting of the building was an exceedingly unusual occurrence. When called upon to wire a residence then the electrical contractor thought of little else than supplying outlets for lamps enough to light the premises—and the disposition to keep the number of lamps as small as could be without failing to secure light enough to meet minimum requirements was rather prevalent.

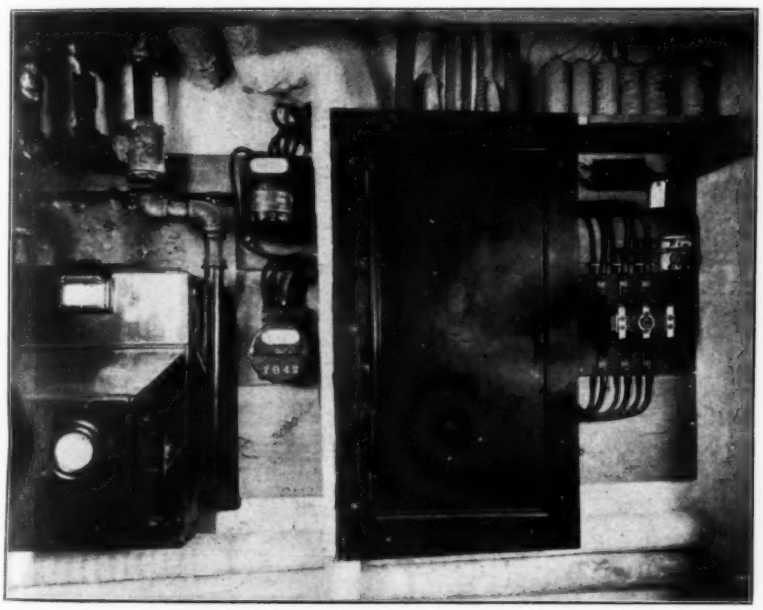


Fig. 1.—View of Portion of Inside of Meter Closet, Showing Service Cabinet, Power and Lighting Meters, Remote-Control Switch, Etc.

But the coming of the metal-filament incandescent lamp so reduced the cost of light that the average householder soon saw that he could use more of it and still have money left to spend for electrical appliances of other kinds than lamps. This condition has unquestionably had a great deal to do with the recent activity in the development of electrical apparatus for domestic use. The lighting service is now scarcely more important than the numerous other advantages that may be realized from the use of electricity in the home.

The electrical contractor should therefore make a constant study of the broad applications of electricity in the home that are now possible, and should seek to impress upon prospective customers the necessity of liberal provisions for the use of domestic electrical appliances in the wiring of the modern residence. Failure to do this is very liable to result in dissatisfaction and an ultimate loss of business. For example, the man who finds that he cannot use some electric heating device or other that is proving popular among his neighbors because no provision was made for it when his house was wired is quite liable, when he has another job of wiring to be done, to seek some other man than the one that wired his residence.

Some idea of the generous provision made for the use of electricity in the residence job with which this article is concerned may be gathered from the fact that, although the building is not larger than the average modern private residence that is designed for the use of a single family, there is, in the various rooms, a total of 36 outlets for attachment plugs, where heating devices, fans, and the like may be connected in circuit. The lighting of the building, too, will be unusually ample and artistic when the installation of the fixtures has been completed; and, as will presently appear, the arrangement of switches and switch circuits is such as to render the control of the lights exceedingly flexible and convenient.

The residence in question is the home of Meyer J. Sturm, a prominent Chicago architect, and is located in Wilmette, a fashionable suburb of the city mentioned. Mr. Sturm himself designed the building and planned the electrical work, which was installed by L. H. Lamont, a Chicago electrical contractor. Fig. 3 is a plan of the basement. The house is approximately 70 feet long, while the width is about 40 feet. The front of the building is to the reader's left as he looks at Figs. 3 and 6. There are a basement,

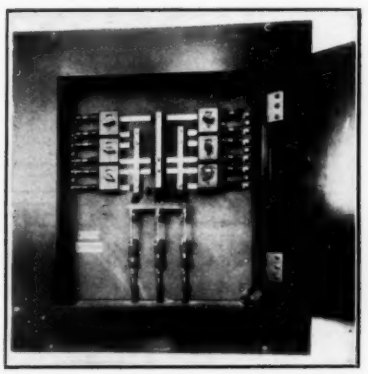


Fig. 2.—Cutout Cabinet for Branch Circuits to Basement Rooms.

two main floors and a third floor or attic.

Electric service enters at the southwest corner of the basement—see upper right-hand corner of Fig. 3—through a conduit brought down on the outside of the wall, from the overhead lines of the local central station, and carried into a Crouse-Hinds steel cutout cabinet. The cabinet is slate lined, and the conduit enters and leaves it in a recess behind the slate slab on which are mounted the service switch and fuses, so that no wires are visible from the front. The service switch is a three-pole unit, and is protected with three cartridge-inclosed National Electrical Code standard fuses, each of 125 amperes rating. Both a spring catch and a lock are provided for the door.

From this cabinet the circuit is run to

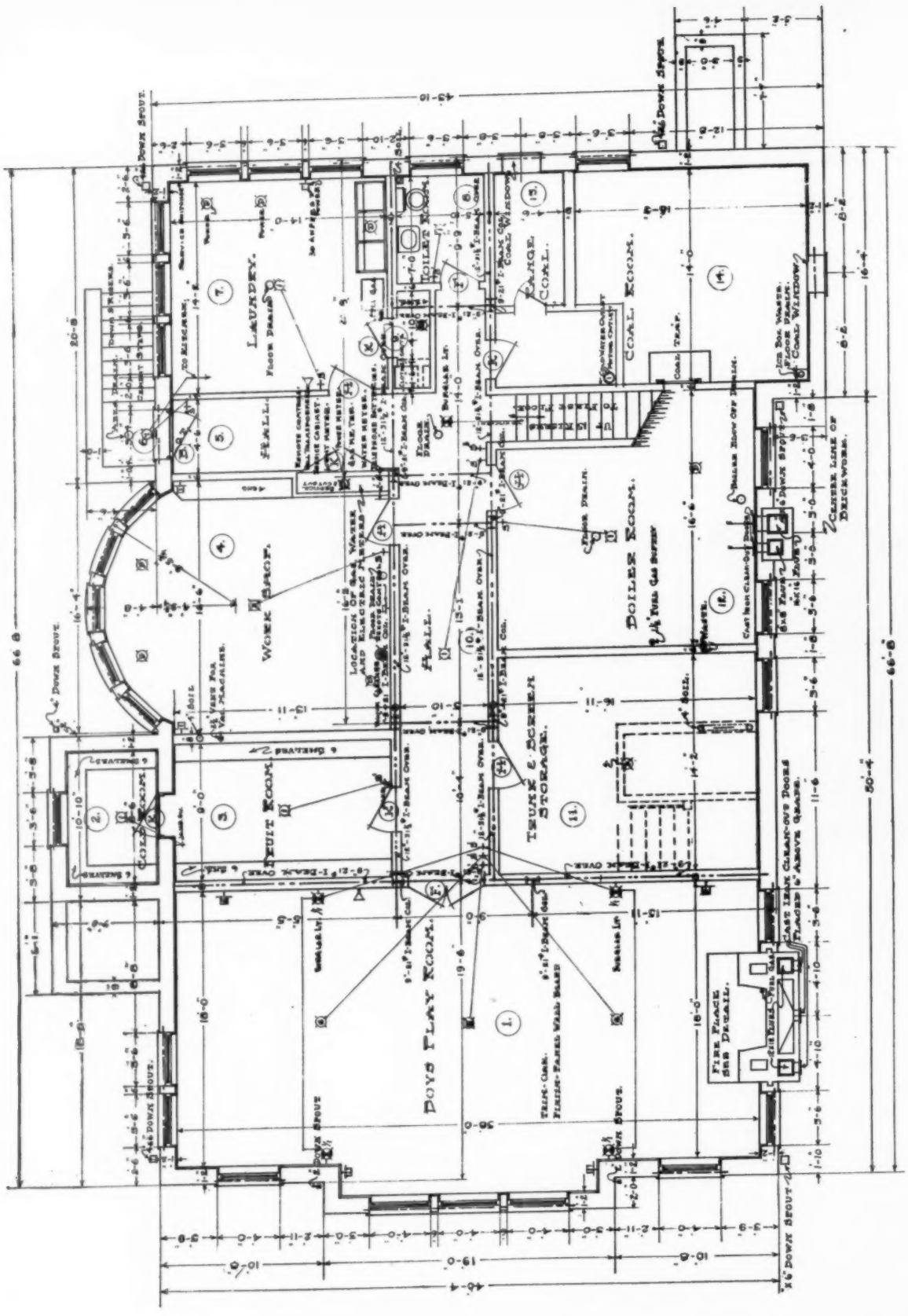


Fig. 3.—Plan of Basement Showing Outlets and Circuits.

a meter closet built in one of the walls of the basement hallway from which the laundry is entered, as shown in Fig. 3, the feeder conduit being run exposed on the basement ceiling. The meter closet, which has double doors opening into the hallway, is amply large to accommodate the main electric service cabinet, the water meter, the gas meter, the electric meters, a remote control switch, the batteries for the house telephones and a bell-ringing transformer; all of this apparatus is grouped here. Fig. 1 is an interior view of this closet. Another thing to be noted about this part of the installation is that the meter closet is so placed as to be easily accessible to meter readers, who may enter the basement hall from a door near by, and also to occupants of the house, who may reach the second floor of the residence. This one is located in a hallway, and has a glass door and an ornamental trim that matches the finish of surrounding parts of the interior.

Notes on Construction.

All the wiring in this building is in conduit, and the so-called white pipe is used. At all lighting and power outlets where a special type of box is not required, standard galvanized, pressed-steel outlet boxes are employed, and these are attached to the conduits with bushings and thin locknuts, in the usual way.

With the exception of the one short run already mentioned, all conduits are concealed. Where wood floors are used all pipes up to three-quarters of an inch in diameter were laid under these floors before the deafening was put on. Conduits larger than this were laid on the staging before the concrete of the floor was poured, or else on the tile of the floor. Horizontal cross runs of pipes in partitions were avoided as far as possible.

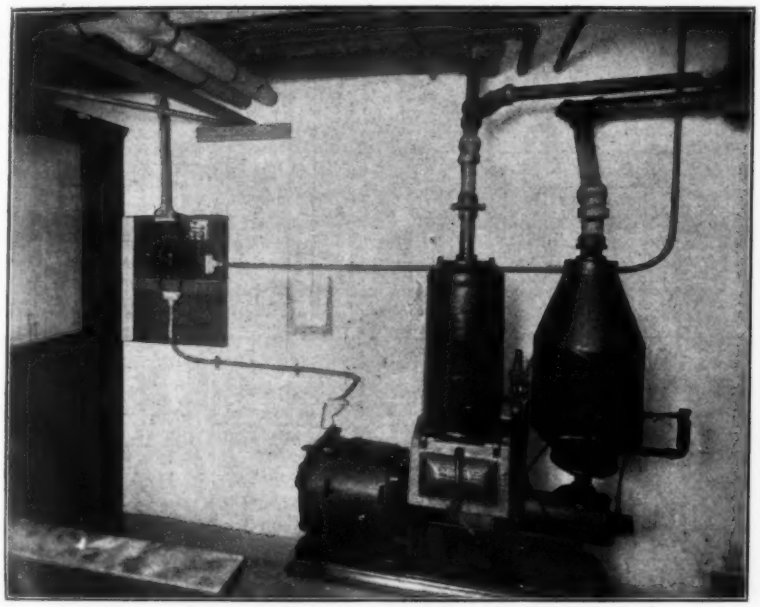


Fig. 4.—Vacuum-Cleaner Installation.

hall where the meters are from the stairway shown in Fig. 3.

Just to the right of the meter closet there is a slate-lined steel cabinet set in the partition wall, with its front surface flush with the wall, which contains the switches and branch-circuit fuses for the basement lamps. Fig. 2 shows this cabinet open. It will be noted that the fuses in these branch circuits are placed between the loads they protect and the switches that open and close the circuits. Like the cabinet in which the service switch is located and the one in the meter closet, this cabinet has its door kept closed by means of a spring catch and lock.

In connection with the electric supply it should be noted that separate meters are supplied for lights and for power.

Fed also from the service cabinet in the meter closet in the basement, there is another main distributing cabinet on the

All conduits were fastened in place, where they were not to be imbedded in concrete, by means of pipe straps or other approved devices, and where other piping crossed electric conduits it was properly blocked to relieve any excessive strain.

As is customary, the entire conduit system was installed complete before any conductors were pulled in.

The telephone system includes house telephones in the principal rooms and telephones which connect with the local public exchange installed in convenient locations. The telephone circuits are run in conduits.

At ceiling outlets shallow outlet boxes were used; and where these came in the concrete work they were placed on the staging, or forms, so that in every instance they were left flush with the ceiling line when the form was torn away. Special pains were taken in the installation of ceiling-outlet boxes to make sure that the fixtures would hang vertical and that the plates would be straight. Three-eighths-inch fixture studs were used in all boxes except those from which combination gas and electric fixtures were to be hung.

Where combination fixtures were to be installed on the ceiling, deep outlet boxes having a center hole to receive the gas pipe were employed. The outlet boxes

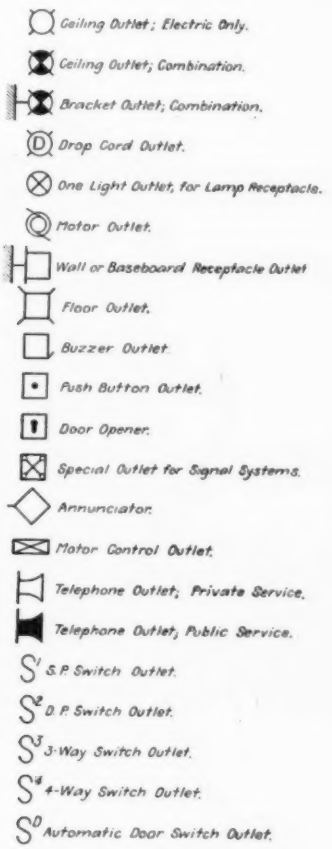


Fig. 5.—Key to Wiring Symbols.

for wall-bracket lamps were similar to those employed for ceiling lights, except that they were provided with galvanized covers for the brackets.

For switches and receptacles for attachment plugs, wall cases made of No. 12 gauge cold rolled steel were used. Standard galvanized-iron boxes were installed at all telephone outlets, both public and private.

No wire smaller than No. 14 B. & S. gauge was used in any lighting or power circuit, of course. Stranded wire was used in all cases where conductors larger than No. 10 B. & S. gauge were required. In making joints in wires, the connection was properly soldered and then the joint was wrapped with rubber tape

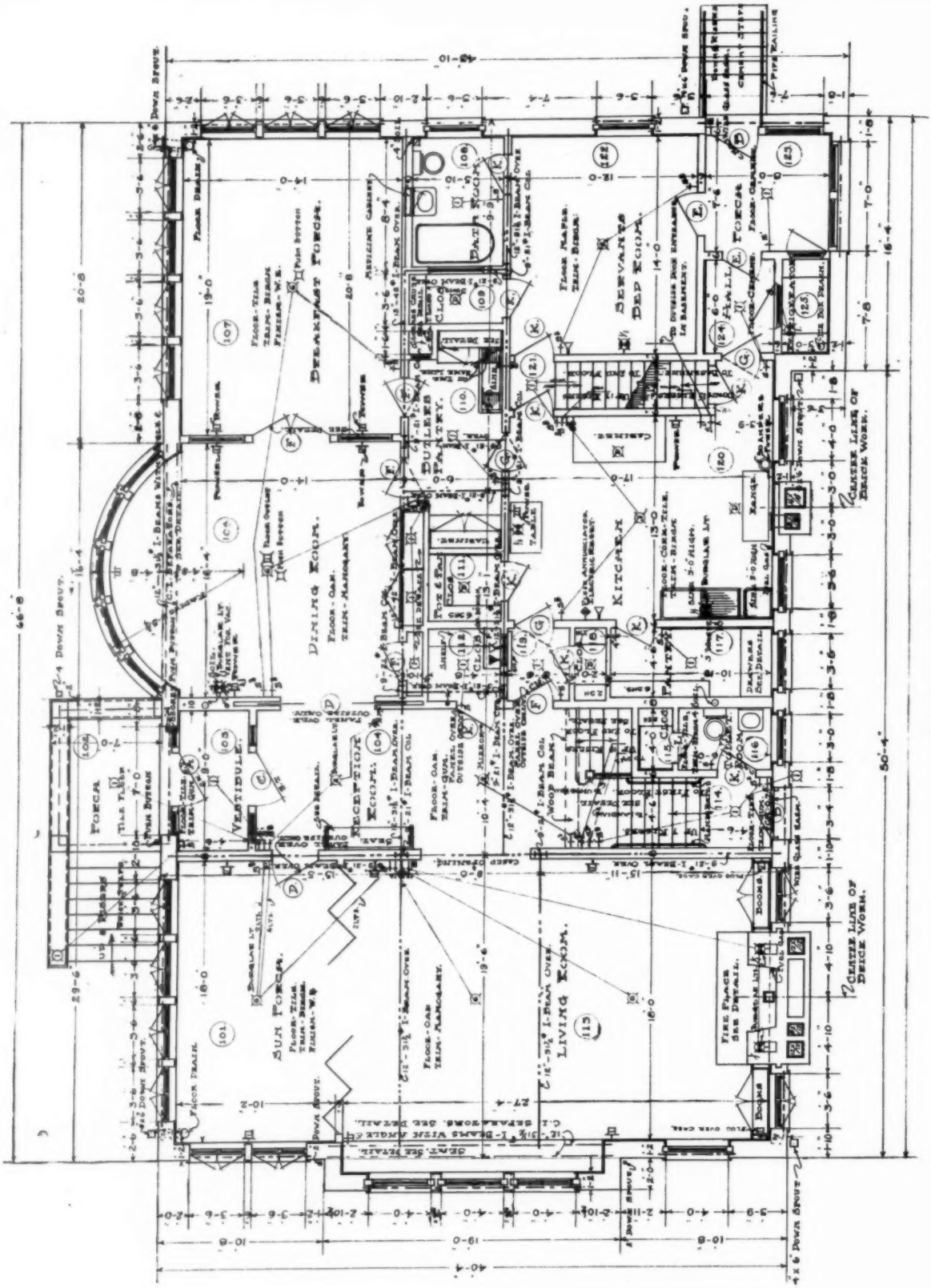


Fig. 6.—Plan of First Floor.

to the thickness of the insulation on the conductors, after which the joint was covered with friction tape extending over the insulation on both sides to make a secure hold.

The number of lights on branch circuits was limited to 12, as was customary when the plans for this installation were drawn, and the conductors are of such sizes that there is not more than three volts loss of pressure between the cutout at the service and the outlet. For circuits more than 100 feet long wires of such a size as to prevent a potential drop greater than one volt were installed, the drop being computed at full load.

Except in a few of the basement rooms where drop lights are employed, all ceiling outlets are controlled by means of push-button flush switches. These are of the "Diamond H" type. The drop lamps referred to are provided with Hubbell pull-chain sockets.

Bell Wiring.

Bell circuits were provided as follows: From the front door to an annunciator conveniently located, and to a bell in the second floor hall; circuits for side and rear-door bells; and circuits from the dining room to the annunciator, from the breakfast porch to the annunciator, and from the living room to the annunciator. In no bell circuit was wire smaller than No. 18 B. & S. gauge used; all the wiring was done with rubber-covered conductors, and special pains were taken not to ground any of the circuits.

There is a bell push at the front door which operates a small buzzer in one of the bedrooms, the object of this arrangement being to make it possible for any member of the family who may be out late at night to have the door opened for him without the necessity of waking anybody but the person sleeping in the room where the buzzer is installed.

Doors on which they are needed are equipped with electrically operated door openers.

Burglar Lights.

Installed in every room into which a burglar might find his way there are lamps known as the burglar lights. These are wired so that they can all be turned on simultaneously from a push-button flush switch in the room where the owner of the house sleeps, and they cannot be turned out from other rooms. The burglar lamps are on a circuit separate from the lamps used in the ordinary illumination of the residence.

Other Notes on Control of Lights.

Reference has already been made to the plan of circuit distribution and the arrangement of cutouts and switches. It should be noted further that the hall and stairway lights are wired on three-way switches, so that they can be turned on or off from either one of two convenient points. Also, where rooms have two doors the lamps therein are controlled by means of three-way switches, there being a switch at either door.

Another feature of the wiring that is particularly interesting is the use of a remote-control switch on the main service. This switch is shown in Fig. 1, at the right of the cutout cabinet. It is a magnetically operated switch, and when it is opened the electric supply is completely cut off from the building. The small switch for operating the control circuit is located at a point on the second floor that can be conveniently reached at any time by the occupants of the residence. By the manipulation of this the current can be cut off from the house and turned on again at will without the necessity of a trip to the service switch in the basement. Such an arrangement is particularly convenient whenever it is desired to turn off the current during a thunder storm at night.

In most of the closets in the house there are lights controlled by means of jamb switches, these being of the "Diamond H" type. The design of these switches is such that opening the door of the room automatically turns on the light, which continues burning when the door is closed the first time but is extinguished by a second opening and closing of the door.

Fig. 4 shows the vacuum cleaner which is installed in the basement of the building, and which is connected by means of suitable piping to various locations in the building. The cleaner is driven by a one-horsepower Century single-phase motor, connected up for remote control. The magnetically operated switch can be seen in the figure just referred to, with the circuit that operates the switch extending to the right, in the small conduit shown. This circuit runs to various points in the house, where momentary-contact switches are installed in it, and by means of these the motor can be started and stopped at will, it being possible to start the machine at one switch and stop it at another or to start and stop it from the same switch.

Mention has been already made of the liberal provisions for the use of electric power in the residence in question for other purposes than lighting. There need be no enumeration of the appliances that can be conveniently connected to this wiring. The wiring includes outlets for an electric stove and for practically any other domestic appliance. It is important to note, too, in conclusion, that the circuits to these outlets were laid out with a view to taking care of the probable load on them; the wire was made big enough to carry it.

Effects of Registration of Electrical Contractors.

On October 1 the Department of Electricity of the City of Chicago, began issuing certificates of registration to such electrical contractors and supervising electricians as made application and met the requirements for registration, the municipal law requiring registration of all persons in responsible charge of electrical construction within the city having become effective at that time. Within the month of October the number of contractors and electricians for industrial plants and the like that registered approached the 500 mark very closely. It was also noticed at the office of the chief electrical inspector that there was a marked increase in the number of permits to install wiring that certain contractors took out. It appears that new ordinance is going to be very effective in stopping irresponsible people from doing wiring, and in preventing contractors who are more or less responsible from assuming the risk of putting in small jobs without taking out a permit at the City Hall.

A Specimen Specification.

A prominent electrical contractor in a Western city was asked to bid on a job of wiring which was to be done according to the following most interesting specifications. The specifications are repeated here verbatim:

"Electric Wire & Fixture.

"Electric wire and fixtures for the warehouse are to be as follows:

"There is to be three-quarter-inch conduit laid in the floor with round outlet boxes, with mark. Marked with double. Cement these boxes and are to be equipped with the drop to the first floor. Where marked 'S' indicate the switch in the first floor. There is to be a light in the first floor and is to be equipped with a knot switch on each light and the side lines are to be equipped with a switch that will be equipped so that it can be taken out in halves. In other words, the half front light should offer as one switch and the same on all other lines except the ones in the center of the first floor.

"In addition to the wire for the light of building the contract also furnishes the conduit and wire to operate the elevator, also for pipe machine."

Guarding Electrical Contractors' Interests.

By a recent act of the Ontario Provincial Legislative Assembly every municipality of sufficient size is now required to organize a municipal electrical inspection bureau (and others of smaller size are grouped in a district) and appoint an inspector, so that all rules and regulations with regard to the correct wiring as aproved by the Hydroelectric Power Commission, may be carried out. Already a number of municipalities have complied with the requirement and others are only wait-

ing the location of a suitable man. Some of the municipalities, however, have been dilatory in complying with the requirements. More or less pressure has been brought to bear by the Commission, but the government as yet has taken no steps to see that its recent enactment is carried out to the letter. The question has been raised, and it is apparently worthy of consideration, whether the municipality, in case of loss of life or property, might not be held liable if it could be shown that a proper enforcement of the law would have prevented the calamity.

In the city of Toronto no inspection bureau has yet been created by the municipality. The private company has its own inspector, as has also the Toronto Hydroelectric system, and the Board of Control has contended that where there was no demand for such an appointment they were under no obligation to make it. However, the question is now being taken up by the Electrical Contractors' Association of Toronto, with the object of showing the necessity for such an appointment under existing conditions, and a resolution was recently passed and submitted to Mayor Hocken favoring the establishment of a municipal electrical inspection bureau that would see to it that electrical installations must be in a perfectly safe condition before connections with the supply mains can be made. It is stated that the not infrequent experience of contractors is that connections are now being made by both systems operating in Toronto that should not be made—the result, to a very great extent, of the competitive conditions existing there.

The electrical contractors at a recent meeting further placed themselves on record as being in favor of the fee system being adopted, with the limitation that the charge for inspection for one building should not exceed $10. The argument in favor of the fee system is that this would make the department self-sustaining, which, it is claimed, would help to remove it from political influence. It was also the unanimously expressed opinion that all contractors should be licensed. This would make it possible to place the blame for poor work on the proper parties and so would make a man careful of his reputation, and would further make it possible in case any particular contractor continued to do unsatisfactory work to remove his name, if necessary, from the licensed list. In this connection it is claimed that much incompetent work is being done by so-called electrical contractors who have not the necessary knowledge and experience, and that quite often large installations of a perfectly satisfactory character are rendered unsafe through some little addition or extension by a novice.

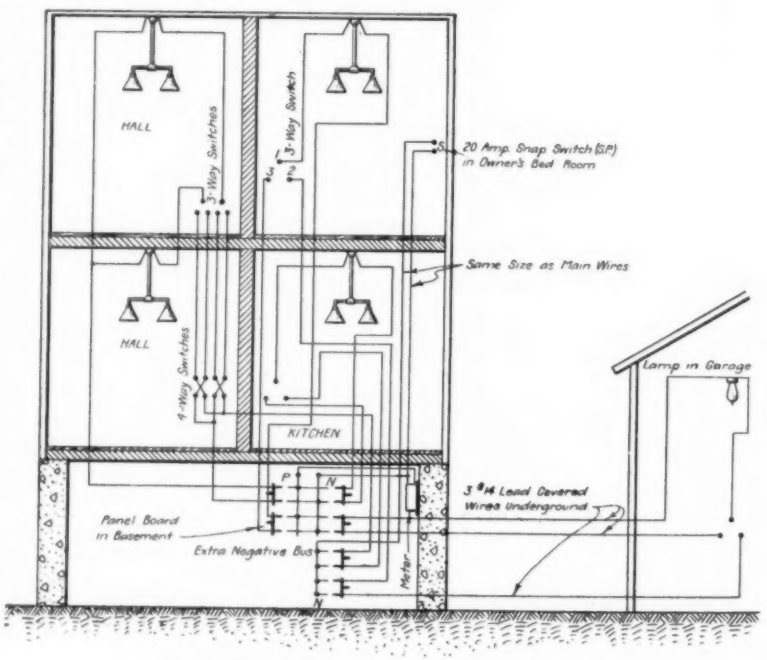
Other suggestions made by the Association were to the effect that no connections should be made to any installation without the approval of a proper inspector; that all electric lighting fixtures be inspected; and that inspection be made within one full working day of the date on which the inspection field.—*Electrical News.*

Wiring Lamps for Protection from Burglars.

In installing wiring in residences the electrician is very frequently called upon to arrange the lamp control in such a way that a large part of the lights or all of them can be thrown on simultaneously from a given point in the house, by one throw of a switch, this sort of protection against possible invasion by burglars being desired. This control, too, must be entirely independent of the switches on individual lamps or fixtures. My way of providing service like this is shown above.

Instead of the ordinary single-pole switches in the rooms I use three-way switches, and for the halls I install four-way and three-way switches. This is a method that provides the desired control in the main building and it can easily be extended to the garage or any other out house.

The arrangement of circuits is made rather simple in the figure, where it will be noted that an extra busbar is required in the distributing cabinet. Consider, for example, the lighting fixture shown in the upper right-hand corner of the figure. While the connection is from *1* to *3* in the three-way switch current will pass from the busbar *P*, through the lamps and back to the busbar *N*, in the normal way, and the lamps in this fixture will burn. Throwing the connection from *1* to *2* in the three-way switch extinguishes these lights, under ordinary conditions; but by closing the 20-ampere snap switch in the owner's bedroom they can be lighted, and they cannot be turned off while that switch is kept closed. As is clear enough from the diagram, the path of the current is then through the lamps from busbar *P*, to what is marked "Extra Negative Bus," and back to the line by way of the 20-ampere snap switch in the owner's bedroom. It is an easy matter to trace the current, in a similar way, through any of the other fixtures or lamps.



Method of Wiring Lamps for Protection Against Burglars.

It is understood, of course, that although a 20-ampere switch is specified in the sketch, a smaller switch may be used on installations where there are only a few lamps.

B. H. Fisher.

The Hawkins Electric Company, Springfield, O., has been awarded contracts for wiring the Majestic Theater for 1,600 lamps to be used in outline work. There will also be provision for illumination with semi-indirect bowls. This company also has the contract for the Alhambra Theater, which includes two electric signs of 1,000 lamps as well as 400 outlets; also for the railroad passenger station in Middletown. All of these installations will use conduit and be equipped with panel boards.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Special Wiring for Floor Plugs.

Not long ago I was called upon to install two receptacles in the floor of a storeroom to provide connection for plugging in an advertising device. It was desired that these receptacles be so wired that the current could be cut off from them by means of a time switch which had already been installed to control window lights, or that they could be cut out of circuit independently by means of manually operated snap switches. Fig. 1 shows how I wired the two receptacles.

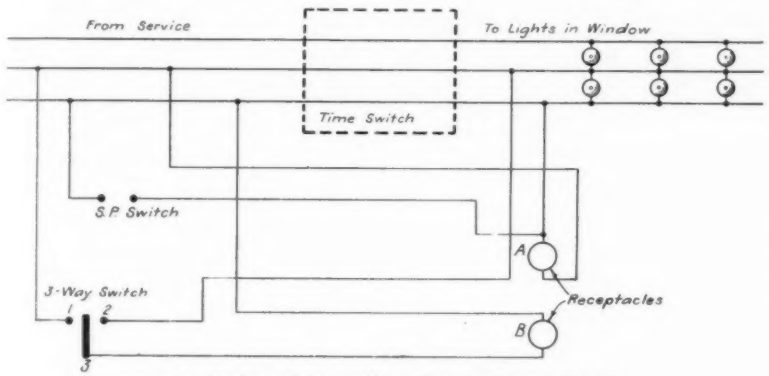


Fig. 1.—Method of Connecting Floor Outlets in Circuit.

It will be noted that to receptacle *A* was connected a lead having a single-pole switch inserted in it, while a three-pole switch was connected in an extra lead brought out for receptacle *B*. By closing the single-pole switch, plug *A* can be kept alive whether the time switch is open or closed; plug *B* can be thrown on a live circuit with the time switch open by simply throwing the three-way switch across between points *3* and *1*.

Karl S. Wonderley.

Fishing Wires in Walls and Partitions.

In wiring old houses, it is often found that to get up through the walls of the first story the floor has to be taken up over a partition in the lower story which is not in line with any partition wall in the second story, and holes made in the crown-plate at the top of the lower partition. This usually happens to be in the middle of an upper hall—or worse, in a bathroom.

I usually avoid disfiguring the floor by drilling one hole in it and then using an extension bit for drilling the crown-plate underneath. By swinging the brace slightly to one side or the other before the hole is started through the plate, it is easy enough to drill five or six holes in the plate through the single hole made in the floor.

To draw in the wires, a plumb line should be dropped through the hole in the floor and shaken from side to side until it passes through the hole in the plate, after which the line can be fished out at the outlet below. The conductors are then drawn up through the floor until there is wire enough pulled through to reach the point to which the circuit is being run. When this has been done, the baseboard should be taken off at the side and a fish wire passed between the floor and the ceiling, and the wire to be drawn in caught up as close to the floor as possible. Then, while the conductor is being pulled in, the wire should be crowded back through the hole in the floor, it having previously been made certain that the conductors are all fastened at the outlet. This process should be repeated for each wire.

To fill the hole in the floor, a piece of lumber of the same grade as the floor itself should be employed to make a plug that tapers slightly, and the grain should run cross-wise, so that when it is planed off, the grain will run in the same direction as the floor.

By proceeding in the manner indicated, wires can be installed with practically no injury at all to the room.

R. H. Eddy.

Fishing Wires in Fixtures Arms.

Fig. 2 illustrates a method I employ in wiring difficult arms in electric fixtures. I take a chain off of a pull socket, tie a piece of stout linen thread to one end of it long enough to reach through a fixture arm, and then fasten a piece of No. 18 copper wire of the same length to the thread. The chain can be shaken around the most troublesome angles and the thread is long enough to pull the copper wire through, this being a bare wire always. When the bare wire has been pulled through, it is a very simple matter to attach the fixture wires and draw them in.

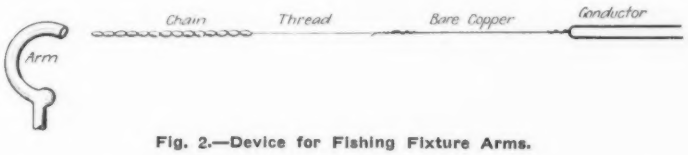


Fig. 2.—Device for Fishing Fixture Arms.

George R. Lackey.

How to See Between the Joists in a Finished House.

A thing that the wireman has to guard against in installing circuits in finished houses is any unnecessary tearing up of floors or walls. So any arrangement that makes it possible to explore the wireway without disturbing the floor or wall along it, is usually well worth consideration. I have found the following to be serviceable. I make a pocket or opening at each end of the run, the ends usually being on opposite sides of the room, and in one of these openings I set a candle, and place a mirror in the other. By looking in the mirror, one can easily see everything that is under the floor between the two joists on opposite sides of the path along which the wires are to be pulled. This scheme is a most convenient one.

J. G. Wetmore.

A Tool for Catching Solder.

It happens rather often that the electrician is called upon to solder joints in open wiring that come directly over some object on the floor that cannot be moved, and that has to be protected from solder or paste that is liable to fall on it. The device illustrated in Fig. 3 will be found very convenient then. It consists of a tiny pail made by closing up the bottom of a fixture canopy and fastening a short piece of wire with a hooked end on either side of it. These hooks are used to hang the pail underneath the joint; thus it is made practically certain that whatever solder or paste may drop will be caught.

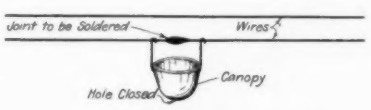


Fig. 3.—How Tool is Used.

J. H. Smith.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, president, 59 Deerfield Street, Hartford, Conn.
H. S. WYNKOOP, vice-president, 13 Park Row, New York, N. Y.
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Executive Committee

EUGENE N. DAVIS, chairman, Brookline, Mass.

Frank R. Daniel, R. P. Strong, Henry A. Knight, C. H. Fletcher, Washington Devereux, James B. McCarthy, James H. Fenton, R. J. Forsyth, C. W. Mitchell, A. W. Hopkins, G. W. Perry, George L. Collison, T. H. Fritts, A. H. Soper, T. W. Bowry, F. G. Hartwell, A. A. Moffitt, Thomas D. McColl

Secretary's Message.

Our members and friends have now had an opportunity to read fully the new Articles of Association recently adopted, together with the important message written by our President, Mr. Day.

The Secretary had hoped that he would have an article by our vice-president, Mr. Wynkoop, upon section membership and collateral matters, but Mr. Wynkoop has explained that press of departmental business together with certain home matters have combined to render it impossible for him to prepare any matter in time for this number.

Among these matters would naturally fall a careful explanation of the voting principle adopted. This, which has appeared complicated to some of the members, is really the result of a very lengthy study and consideration of the problem of how best to give each branch, sections scattered over the country, and members at large their just weight in the meetings, and also how to avoid the ruling of a meeting by the relatively large attendance of members located within easy reach of the place of meeting.

Mr. Wynkoop devoted a large amount of thought to this matter and the Secretary feels that he, of all those on the Special Committee charged with the preparation of the Articles, can best explain the result we desired to reach, and which we hope has been accomplished though, of course, the only sure test is in the actual try-out.

The Articles as printed were taken from the final draft sent out to the Executive Committee for approval before submission to the membership at large. As a result of suggestions received later there are a few changes which should be noticed, and the Secretary desires that the members and others interested write the following corrections in the margin of the Articles as they appear on pages 871 and 872 of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for November 1:

Page 871, near foot (Special Meetings), read "Shall be called" instead of "May be called."

Page 872, near foot, first column (Membership, (C) Retired Inspectors), add the words "members of this Association at time of retirement and while not engaged in any business inimical to the interests of this Association."

Page 872, middle column, at end of second paragraph, add "The membership fee, payable upon the sending in of the application and to be returned in case of non-election, shall be one dollar. All applicants for membership shall submit their applications to the Secretary, who shall submit the same to the Executive Committee and upon the approval of a plurality of the latter the applicant shall become a member of this association."

In regard to the questions, answers to which are printed herewith, the Secretary wishes to say that the replies were received early in September, but that the press of other matters has made it entirely impossible to get them in shape until now. From now on he expects that the matter will be run regularly twice a month—if only the members will assist with questions. In addition, he desires to say that answers to these three questions were received from Executive Committee Member Fletcher, but in some way they have been misplaced, and, although the Secretary feels positive they must be almost under his hand, yet upon the strictest search he finds himself entirely destitute, so far as they are concerned; he wishes humbly to apologize for the mishap.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Flexible Conduit in Brick Walls.

Question 240. Should it be considered permissible to install single or double-strip flexible metallic conduit in chases cut in dry brick walls, assuming that rigid metallic conduit would be used wherever possible on the job?

Answer 1 (F). Rule 27*d*, National Electrical Code, permits the use of armored cable under these conditions.

Answer 2 (U). Yes.

Answer 3 (J). Rule 27*d*, last paragraph, explicitly permits the practice of running armored cables in the manner indicated in the question, regardless of whether rigid metallic conduit could be substituted or not.

Answer 4 (E). It would be permissible to use any type of approved metal flexible conduits, provided there was no maintained dampness or moisture. If there was dampness, we would require rigid metal conduit, or else armored cable having a lead sheathing between the outer braid of the insulation of the wires and the inside of the armor.

Answer 5 (O). Code rules for conduit work make no distinction between rigid and flexible conduit.

Answer 6 (Q). Yes.

Answer 7 (D). We see no reason

to object. In this territory no bad results have been experienced in the use of armored cable in wall channels where the cable was covered with a light plaster finish; there does not seem to be enough moisture in the plaster to affect the conductors.

Answer 8 (P). It has always been our practice to approve either single or double-strip flexible metallic conduit plastered into chases in dry brick walls, our only prohibition of this type of construction occurring when it is attempted to lay the conduit under tiled floors or in poured-concrete buildings where the grouting might be expected to creep between the strips and harden on the inside.

Answer 9 (N). There is nothing in the Code to prevent this arrangement.

Answer 10 (I). We can see no objection to this sort of construction.

Insulation from Gas Pipes at Gas-Electric Outlets.

Question 241. Code Rule 30a, second paragraph, requires the protection of gas pipes above the insulating joint at fixture outlets. Should any exception to this be allowed by the inspector in the case of a conduit installation, where the entire box inclosure is a grounded surface, and where consequently the utility of the prescribed protection might be questioned?

Answer 1 (F). The rule referred to requires the protection of gas pipes above the insulating joint, and this protection is just as necessary in a conduit outlet box as it is in any other method of installation. Its purpose is to protect the wiring from accidental contact with the gas pipe which may burn a hole in same and ignite the escaping gas.

Answer 2 (U). No rule should be broken unless absolutely necessary. I see no advantage in breaking the rule in this case.

Answer 3 (J). No; the Code makes no distinction between a knob-and-tube job and a conduit job in this regard. The consequences of an arc between wire and gas pipe are apt to be far more serious than those resulting from a contact with the outlet box, and this consideration should govern in requiring the same protection for the gas pipe in either case.

Answer 4 (E). We think it best to protect the wires from a possible contact with the gas pipe, whether the wires are in a grounded box or not.

Answer 5 (O). The protection of gas pipes above insulating joints should be required in all cases, and its omission constitutes a serious fire hazard, whether in an outlet box or not. The questioner has failed to grasp the reason for the protection required by Rule 30*a*, which protection is needed not because the gas pipe is a grounded surface but because an arc to the gas pipe is very apt to puncture the pipe and ignite the escaping gas.

Answer 6 (Q). Exception should be allowed.

Answer 7 (D). The idea of requiring protection on gas pipes above insulated joints is to guard against wires coming in contact with the gas pipe, which in everyday practice are usually twisted about this portion of the pipe above the insulating joint in order that the canopy may be raised to position. The insulation of the wires at this point is weaker than at other points in the system and is liable to cause an arcing with gas pipe when the insulating qualities are broken down. For this reason, we do not believe it advisable to make any change under the conditions outlined.

Answer 8 (P). The exception should not be allowed where there is any probability of wire coming into contact with the grounded gas pipe. Even if the entire box inclosure is a grounded surface it is still particularly desirable to prevent an arc from burning a hole in the gas pipe.

Answer 9 (N). No. There is no distinction made; the presence of the shield about the gas pipe tends to make more secure against an arc to it. Of course, this amounts to nothing if lightning gets in and takes it into its head to aim for ground via the gas pipe; it will go in spite of a piece of insulating tubing, and probably the arc will follow. In any other emergency the arc would probably be prevented, together with all its attendant dangers.

Answer 10 (I). Yes; see last paragraph of Rule 27*d*, and also Rule 57*a*. We presume that by "box inclosure" the fixture canopy is meant in this case, and we do not see how, under the Code, the inspector could permit the canopy to be grounded, unless the insulation of the fixture wires were equivalent to the insulation of the rest of the circuit. It seems to us that he would be compelled to insist upon the insulation of the canopy and the use of insulating tubing above the insulating joint in the fixture. If he permitted the installation of grounded canopies it would hardly seem consistent for him to insist upon the use of insulating tubing to protect the gas pipe.

Control of Emergency Lights in Theaters.

Question 242. Does Rule 38t, third paragraph, prohibit the placing of the service switch and cutout in any other place than the lobby or front of the house, provided there is a controlling switch in the lobby?

Answer 1 (F). The third paragraph refers to the position of the switch only, and, as the rule says these lights must only be controlled from this part of the house, we assume it prohibits the placing of a switch at any other point.

Answer 2 (U). Yes.

Answer 3 (J). I understand this rule to refer to the switch or switches provided for ordinary control of the exit and emergency lights. It must not be possible for this circuit to be interrupted from the stage or controlled at the stage switchboard. The service switches, however, may be located at any convenient entrance point not liable to invite interference or tampering with the apparatus.

Answer 4 (E). The service switch for the emergency circuits must be placed at the point of service entrance, which should be in a readily accessible place. The controlling switch, however, must be located in the lobby or other convenient place in the front of the house. In this connection, it must not be forgotten that the emergency circuit must have no connection with the stage equipment or with the general lighting of the auditorium.

Answer 5 (O). Any switch installed in the emergency circuit controls the circuit. Rule 38*t* permits the control only in the front of the house.

Answer 6 (Q). No, when system can be controlled from lobby.

Answer 7 (D). The service switch for emergency and exit lights may be placed at any accessible point, provided it is properly incased in an approved cabinet.

Answer 8 (P). Since Rule 23*a* designates the proper place for the service switch and cutout, it would seem clear that the lobby would be the proper place for such switch and cutout only in those cases where the service enters at that point. If there is only

one main available in the street, one service may be brought into the premises and there split, one branch going through the main house service switch and cutout and the other going through the emergency house switch and cutout, the emergency lighting being controlled from the "front of the house." Usually the lobby is too exposed a place for the emergency lighting switch, and it seems to have become a settled practice to place this switch in the box office, where the public cannot tamper with it.

The split service, of course, requires two meters unless the company chooses to put the emergency lighting on a flat rate. We have insisted upon this, however, on account of our firm belief that many a panic has been averted by avoiding a condition of total darkness in the theater.

Answer 9 (N). Rule 38*t* refers to ordinary control; it says nothing as to service switch either by implication or by reference to Rule 23*a* (cutouts) or 24*a* (switches). Nevertheless, the distinction in wording between these two might suggest a possible modification in this case. I do not think, however, that it was intended, and I should require service fuse at point of entrance, size just as large as wire would stand to protect purely against short-circuit, service switch at nearest accessible point, working fuses in box office to protect circuit all except run up to that point and control switch also in the box office. Lobby is too public and liable to be crowded with excited people in case of emergency.

Answer 10 (I). The practice in this city, with reference to theater wiring, is to require the usual service fuse and switch where the service enters the house and to require switches for controlling the exit, hall and corridor lights to be located in the front of the building. It is assumed that the liability of the service fuse blowing or the service switch being opened at a critical moment is very remote. When the house service comes in on the stage, the practice is to install a fuse for the protection of the lights mentioned there, and to place the control switches in the front portion of the building.

The Audion Detector.

At the meeting of the Institute of Radio Engineers on November 5, Lee deForest addressed the Institute on the audion as a detector and amplifier. The development of this gaseous detector was sketched, and the apparatus in its present form demonstrated. Applications to high-speed radiotelegraphy and to line telephony were discussed, and the statement made that the amplification secured was a continuous effect even at amplitudes far below the observable minimum of incoming energy.

In the discussion which followed the paper, John S. Stone commented on the desirability of the audion for use in "wired wireless" multiplex telephony, where the rapid loss of speech energy as distance is increased must be compensated by great delicacy in the receiver.

The next Institute meeting will be held on December 3, at Columbia University. E. F. W. Alexanderson, of the General Electric Company, will present a paper on some recent developments in high-frequency alternators.

Public Service Commissions

CALIFORNIA.

The Railroad Commission has issued a supplemental order in which it allowed the Tulare County Power Company to carry to completion its proposed issue of notes amounting in the aggregate to $250,000.

A decision was rendered granting authority to the Reedley Telephone Company to issue $2,500 of stock.

The Southern Sierras Power Company was granted authority to renew $10,000 of promissory notes for the purchase of property of the Lytle Creek Power Company.

The United Light & Power Company was granted authority to issue a note in the sum of $6,000.

A decision was rendered granting authority to the Napa Valley Electric Company to purchase the property of the Calistoga Electric Company and to issue $20,500 of bonds, $15,300 of stock and $5,000 of notes.

A decision was rendered granting authority to the Pacific Telephone & Telegraph Company to issue $3,000,000 of bonds. The proceeds will be devoted to retiring $850,000 of underlying bonds and to improvements in the company's plant.

A decision was rendered granting authority to the Pacific Light & Power Corporation to issue $52,300 of stock. The company was denied permission to issue $1,720,000 of bonds.

A decision was rendered granting authority to the San Diego Consolidated Gas & Electric Company to issue $27,000 of bonds for additions and betterments to the company's plant.

A decision was rendered granting authority to the Dos Palos Telephone Company to issue $1,273 of stock.

NEW YORK.

The Belt Line Railway Corporation, operating the Fifty-ninth Street and Belt Line street railroads, has been authorized by the Public Service Commission for the First District to increase its capital stock from $600,000 to $750,000. The company had already issued, under authority of the Commission, $481,000, and recently applied for permission to increase the total amount of stock in the sum named, also for authority to issue $269,000 of stock to pay for the acquisition of 79 storage-battery cars. This amount, with the amount already issued, would make a total of $750,000. The company had already expended $128,090.40 for the purchase of 40 storage-battery cars, with money borrowed from the Third Avenue Railway Company. The Belt Line Corporation wants to buy 39 additional cars of the same type, and the cost is estimated at about $3,200 a car, or $124,800. These two amounts make a total of about $253,000, and the Commission's order authorizes the company to issue capital stock to that extent. The order authorizes the Third Avenue Railway Company, which owns all the bonds and stock of the Belt Line Corporation, to acquire and hold all of the new capital stock of the latter corporation authorized.

MASSACHUSETTS.

The Gas and Electric Light Commission has granted authority to the Weymouth Light and Power Company to issue 300 shares of new capital stock at $150 per share, to finance additions and improvements in plant represented by notes.

THE USE OF REFRIGERATING APPARATUS TO AID IN COOLING DYNAMOS ON OVERLOAD.

By Sydney F. Walker.

One method of cleaning the air that is employed for cooling dynamos is known as a wet filter. It consists of a box, in which a number of very fine jets of water are made to impinge upon the current of air passing through the box; the effect produced being similar to a mist, or a cloud. The passage of the air through the mist has the double effect of cleansing the air from particles of dirt, and of lowering the temperature of the air to that of the water employed.

In the following article, the writer proposes to discuss the feasibility of the use of this apparatus to enable generators to deal with an overload by supercooling the water from which the spray is taken, and to show roughly the qualities of air and the size of refrigerating apparatus that will be required for machines of given output.

In attacking the problem, the writer has experienced some difficulty in obtaining information upon which to base his calculations. The construction of machines by different makers necessarily varies in detail; and to make a complete calculation for each machine, it would have been necessary to have taken into consideration the surfaces and weights engaged. As these figures were not available, the writer has attacked the problem from another side. He has taken the actual losses that will probably occur in different machines under different conditions; and he has estimated the quantity of air required to abstract the heat representing those losses; and the size of the refrigerating plant required to cool the air, that is to circulate through the generators, down to different temperatures.

In passing, he would remark that the operation of cooling dynamos by the passage of air through them should be very efficient indeed, so far as the quantity of air employed is concerned. With both air cooling and water cooling one of the great difficulties that is encountered, that renders the efficiency of the arrangement usually low, is the fact that it is the skin of air or water, that portion of the air or water actually in contact with the surface to be cooled, that performs the work. Both air and water are bad conductors of heat. When a current of air passes over a hot surface it is only the air immediately in contact with the hot surface that abstracts heat from the surface. The air which is at even a very small distance from the heated surface takes practically no part in the operation. When air is not kept in motion by mechanical means, by fans, furnaces, etc., convection currents are set up; the skin of air whose temperature has been raised by contact with the heated surface passes away from that surface, and gives place to a fresh skin of air; but where, as in the problems involved in cooling dynamos, a current of air is forced over the heated surface, no action of that kind can take place. In a large proportion of dynamos, at any rate in modern machines, the revolving portion is only a small fraction of an inch from the stationary portion; and therefore the whole of the air passing through this space may be assumed to take part in the cooling operation. Where it is arranged for air to circulate through the interior of the revolving portion—a somewhat difficult matter—something of the same kind of reasoning holds.

The calculation then resolves itself, in the form in which the writer has approached the problem, into estimating the quantity of heat delivered to the dynamo per minute; the quantity of air required to carry off that heat, with various differences of temperature between the moving air and the heated parts of the machine; and in addition, the estimation of the refrigeration plant required to reduce the temperature of the entering air, through various ranges.

It may be mentioned that a certain amount of cooling should take place from the surfaces of the machines themselves. The mere revolution of the rotor sets up a current of air, and there should be a certain amount of heat conveyed away from both the stationary and revolving portions of the machines, by radiation and convection. In most modern electric generating stations, however, in the United Kingdom at any rate, the writer fears that the quantity of heat conveyed away from the machines in this way, is not large. At any rate it is not as large as it might be, if the engine houses themselves were kept at a lower temperature. In almost every generating station the writer has visited, the atmosphere is warm, and sometimes moist; so much so in fact, that he has wondered at engineers, oilers, etc., being able to stand it for long. He suggests that it would add to the efficiency of the plant, and to the efficiency of the staff, if the problem of ventilating and cooling power houses were tackled in a scientific manner. The temperature of the power house should be kept at not greater than 60 degrees Fahrenheit, and the humidity should be kept at as low a percentage as possible. If the temperature of the engine houses were maintained at 50 degrees, and the humidity at even a high figure; or if the temperature was maintained at say 70 degrees, and the humidity at a low figure, the power house would be a very much more pleasant place to work in; and in addition, any machine, working at full load or even less, would keep at a lower temperature, owing to radiation, and to the convection currents that would be set up, than is possible under present conditions.

A Concrete Case.

The writer proposes to take the case of a generator with an output of 1,000 kilowatts; and to consider the heat which would be delivered to it; (1) at full load; (2) at 25 per cent overload; (3) at 50 per cent overload. He assumes that the efficiency of the machine is 91 per cent at full load; 87 per cent when running with 25 per cent overload; and 83.5 per cent when running with 50 per cent overload.

The writer assumes also, that the whole of the energy represented by the losses, 9 per cent, 13 per cent and 16.5 per cent respectively, is converted into heat. The causes of losses of energy are various but the writer believes he is correct in saying that in all cases heat is the resultant product. It remains, then, first to convert the respective losses into heat, and then to estimate the quantity of air required to carry off the heat.

The total losses respectively are, 100 kilowatts at full load; 188 kilowatts at 25-per-cent overload; and 300 kilowatts at 50-per-cent overload.

Taking the British thermal unit as equal to 17.6 watt-minutes, the 100-kilowatts at full load will deliver approximately 5,700 heat units per minute to the machine. The 188 kilowatts will deliver approximately 10,700 heat units per minute; and the 300 kilowatts will deliver 17,000 heat units per minute.

The British thermal unit, it will be remembered, is the quantity of heat required to raise the temperature of one pound of water through 1 degree Fahrenheit. It will raise the temperature of approximately 55 cubic feet of air, 1 degree Fahrenheit. It is necessary to use approximate figures in this case; because, as is well known, the specific heat of air at constant volume differs considerably from that at constant pressure. Under ordinary working conditions, where air has to be cooled, or is used for cooling other bodies, it does not remain at constant pressure, nor at constant volume. He has found the above figure answer for practical purposes. This means that 55 cubic feet of air, whose temperature is raised through 1 degree Fahrenheit, will abstract one heat unit from the heated body with which it is in contact, assuming that the whole of the air takes part in the operation. When raised 10 degrees the same quantity of air will abstract 10 thermal units; and so on.

In the next part of the problem, a certain assumption has to be made. The temperature to which machines are raised in working varies, as also does the temperature of the surrounding air. The writer has made calculations for three differences of temperature, between the surfaces to be cooled and the air which is cooling them; viz., a difference of 50, 80 and 100 degrees Fahrenheit. Disregarding the difference of temperature between the surfaces to be cooled and the air which is employed to abstract heat from them, but assuming that the temperature of the air is raised 50 degrees in its passage through the machine, to carry off 5,700 heat units per minute will require approximately 6,300 cubic feet of air per minute. To carry off 10,700 heat units, under the same conditions, will require 11,800 cubic feet of air per minute. To carry off 17,000 heat units will require 18,700 cubic feet of air per minute.

If the temperature of the air is raised through 80 degrees Fahrenheit, the figures will be as follows: To abstract 5,700 heat units per minute will require a circulation of 3,920 cubic feet of air per minute. To abstract 10,700 heat units will require 7,350 cubic feet of air per minute. To abstract 17,000 heat units per minute, will require 11,700 cubic feet of air per minute.

If the temperature of the air in passing through the machine is raised through 100 degrees Fahrenheit, the quantities of air required will be respectively, 3,140, 5,900 and 9,350 cubic feet per minute.

The advantage of raising the temperature of the air passing through the machine, through a wide range, is immediately apparent; but the question at once arises, how is this to be done. The reply is, by lowering the temperature of the incoming air. Assuming that air is merely at ordinary temperatures, or is cooled to ordinary average temperatures, say in the neighborhood of 60 degrees, it may be taken that by proper arrangement the rise of temperature given in the first series of figures, viz., 50 degrees, can be obtained. It should be understood of course, that not much has been done in the way of measurement of the rise of temperature of air, under similar conditions; but from figures that are available of experiments made in connection with ventilation, the writer makes out that the above rise of temperature, under the peculiar conditions ruling in dynamo machines, may easily be obtained.

If a larger increase of temperature of the air is to be obtained, it can only be done by lowering the temperature of the incoming air; and that is where refrigerating apparatus comes in. Taking the average temperature of the air as 62 degrees, by lowering it to freezing point, the additional 30 degrees required for the range of 80 degrees mentioned above, is obtained; and by lowering the temperature of the air to 12 degrees, the further 20 degrees range is again obtained.

A difficulty at once arises here, if the wet air filter is employed. Pure water freezes at 32 degrees, and therefore the operation of the filter will be stopped, if pure water is depended upon. But refrigeration engineers are accustomed to dealing with apparatus which lowers the temperature of the air to any figure that may be required. In the latest method employed, for instance, in cold storage, air is kept circulating through each cold chamber, the air which enters the chamber having previously been cooled to whatever figure may be desired, and dried at the same time, by passing through a refrigerating plant.

There are two methods of lowering the temperature of the air below freezing point. In one method, the air is caused to pass through what is practically a bath of cold brine; brine whose temperature has been lowered a few degrees below that to which the air is to be reduced. It will be remembered that by dissolving any salts in water, the freezing temperature of the solution is lowered; and refrigeration engineers by properly preparing the density of the solution, usually of calcium chloride, are able to produce a brine, circulating at any temperature that may be desired. It is obvious that in place of water, cold brine at any temperature desired could be employed, the air passing through the bath of cold brine, just as it now does through the midst of watery vapor. Certain modifications would have to be arranged in the apparatus. The very fine sprays could probably be used, because of the deposit of salt in the holes through which the sprays issue. In cold-storage apparatus, no difficulty has been found in dealing with the problem. In one method, a battery of corrugated iron plates hangs vertically over a trough; and cold brine trickles down over the plates, the air to be cooled passing between them. It is obvious that the air filter could be arranged on these lines.

In some cases, the air is cooled directly, by passing it over either a grid of pipes through which cold brine is circulating; or in which the refrigerant itself, ammonia, carbonic acid, or sulphurous acid is circulating. In the cooling and drying of the air for the blast furnace, which is now a thoroughly established practice, grids of pipes in which brine is circulating are usually employed. On the other hand, where it is convenient to use carbonic acid, the cooling of the air is obtained by passing it directly over the expansion pipes, the pipes in which the carbonic acid itself is circulating. The cooling effect in all refrigerating plants is obtained by the conversion of a liquid refrigerant, ammonia, carbonic acid, or sulphurous acid, into a gas. The gas is afterwards compressed, and re-condensed to the liquid condition, and is allowed to re-expand, and so on. Direct expansion, as the method is called, in which air to be cooled passes over the grid of expansion pipes, has the objection, where ammonia is the refrigerant, that in case of escape of ammonia, say through a leaky joint, serious results might follow. On board ship, carbonic acid is almost universally employed as the refrigerant, because of its greater safety; and as the electrical plant on board ship is becoming increasingly large, and as it is possible that it may be convenient to overload a machine occasionally there, carbonic acid would be the refrigerant employed.

The Sizes of Machines Required.

The only point remaining is to give the sizes of the refrigerating plant required. Refrigerating plant is known as 1-ton, 2-ton, 5-ton, and so on; according as it will perform the work which the melting of 1 ton, 2 tons, and so on, of ice, in 24 hours, would accomplish. One ton of ice in melting to water at 32 degrees Fahrenheit, absorbs 284,000 British thermal units. This accomplished in 24 hours means 197 thermal units per minute.

To find the number of heat units that must be abstracted from the air to cool the necessary quantity to the required temperature by the aid of refrigerating apparatus, we proceed as follows. With the entering air at 62 degrees there is no precooling, and all of the heat is abstracted by raising the air to 112 degrees, a range of 50 degrees. With the entering air at 32 degrees, three-eighths of the heat abstracted must be taken care of by precooling. This fraction of the 10,700 heat units which must be carried off each minute at 25-per-cent overload, is 4,000. The same fraction of 17,000, for 50-per-cent overload, is 6,360. Dividing these quantities by 197 will give the tons of refrigeration necessary: viz., 20 and 32.

With the entering air at 12 degrees, one-half of the cooling must be provided by artificial refrigeration and the refrigeration necessary will be in the proportion of 0.5 to 0.375 of that required before: viz., 27 and 43 tons of refrigeration. The quantities here are higher because smaller volumes of air are used.

For practical purposes it would be wise to use the usual margin for contingencies, since it is notorious that the efficiencies of all kinds of machines generally decrease after they have been in operation for some time. It is real-

ized that the efficiencies assumed in the problem are smaller than those actually attained in good designs of machinery and in this connection it should be mentioned that the lowered efficiency with an overload is principally due to the higher temperature of the different parts of the apparatus; if the heat liberated is carried away the efficiency would, of course, be higher and the quantity of heat to be abstracted lower.

The power required to drive refrigerating apparatus for the above purpose may be taken to average about one horsepower for each ton of refrigeration.

Production of Poles in Canada in 1912.

There were 608,556 wooden poles reported in Bulletin No. 39, Forestry Branch, Department of the Interior, as having been purchased in Canada in 1912. This number is an increase of 22,853 poles, or 3.9 per cent, over the figures for 1911. The average pole has a life of at least ten years, and the demand for poles is, therefore, more or less intermittent, depending on the building of new pole lines.

Nine kinds of wood were reported for poles in 1912, with Eastern cedar heading the list. Cedar has been the most popular wood for telegraph, telephone, and other pole lines, although the purchases in 1912 show a decrease. Wood for this purpose need not be especially strong or hard, as there is little or no mechanical strain to be endured. Durability in contact with the soil, lightness and a slender tapering form are most essential, and cedar seems to fit those requirements better than any other wood used in an untreated state.

The use of the British Columbia species of cedar has increased in the last few years with the decrease in the supply of poles of the Eastern species in the greater lengths. While these poles are not so strong or so durable as those of Eastern cedar, they can be obtained in greater lengths, and the source of supply is more easily accessible. The two species of cedar together formed over 85 per cent of the total.

Balsam fir was reported for the first time in 1912. This wood is being used more and more each year for all purposes, especially in the Maritime Provinces. Increases are noted in the use of Western cedar, tamarack, spruce, and chestnut, and decreases in the use of Eastern cedar, jack pine, Douglass fir and hemlock. No poles were reported in 1912 of red, white or yellow pine.

Steam railways, and telephone and telegraph companies reported the purchase of 549,560 poles in 1912. This number is an increase of 5.4 per cent over the total for 1911.

The electric railway, power, and light companies purchased a total of 58,996 poles, 9.7 per cent of all the poles purchased in 1912. This number is a decrease of over eight per cent from the total in 1912. The electric companies, as a rule, purchase the best class of poles of the greatest length and seldom obtain their supply locally. These facts are probably responsible for the high values, the average value per pole of $4.79 representing an increase of 24 cents over 1911.

Total Mechanical Horsepower in the United States.

The question is frequently asked "What is the total mechanical horsepower utilized by the electric lighting industry?" That question is fairly easy to answer, says the *Bulletin* of the National Electric Light Association, but it has not been quite so easy to say what is the relation of that amount to the power employed in other industries or by the country as a whole. An effort has been made recently, however, by a careful statistician in one of the public utility fields to get at reasonably definite data in this respect, and we are glad to give herewith the results of this most interesting investigation. The figures certainly approximate the truth, for the calculations are based on Federal statistical reports of one kind or another, chiefly those of the Census Bureau, and the percentage of possible error in regard to any large item is small. The table follows:

	HP.	HP.
MANUFACTURERS		
Steam	16,400,000	
Water	1,900,000	
Other	1,100,000	
Total		19,400,000
CENTRAL ELECTRIC LIGHT AND POWER STATIONS		
Steam	5,000,000	
Water	2,600,000	
Gas	100,000	
Total		7,700,000
STREET AND ELECTRIC RAILWAYS		
Steam	3,100,000	
Water	300,000	
Total		3,400,000
Steam railroads (locomotives only)		50,000,000
Steam and naval vessels		4,000,000
Mines and quarries		5,000,000
Custom flour, grist and saw mills (not included in United States census of manufacturers)		1,000,000
Irrigation		400,000
Total		90,900,000
Automobiles		22,500,000
Total including automobiles		113,400,000

The automobile estimate is not from a government report, but is believed to be somewhere near the fact. To the above stupendous total of nearly 115,000,000 horsepower should be added that in use on farms, in isolated light and power plants, by construction companies, etc., representing, say, another 3 to 5 millions, thus giving a grand total of around 120,000,000 horsepower. To this must be added as able members of the great army of industry, the mature horses and mules in the United States, 25,000,000 in the last census enumeration, and probably 30,000,000 today. This brings us up to a final summation of between 140,000,000 and 150,000,000 horsepower, or about 1.5 horsepower per capita for our entire population.

A great many inferences, deductions and conclusions may be based on these figures, and they ought to serve a great variety of useful purposes in stimulating discussion. The fact that already animal power is only one-fifth of our national motive power emerges in a rather startling way, but in view of its average inefficiency there is nothing alarming about it. The horse will long be with us, but the question is obviously how much more we can do without it. The next big factor that looms up is that steam is about 50 per cent or better of the total 150,000,000 horsepower, and the steam locomotives stand for about two-thirds of the 75,000,000 or 85,000,000. The bearing of this upon the central-station situation is obvious, when we are trying to conserve the national resources in coal, oil and natural gas by using instead the water power that renews itself perpetually. It is often asserted that the purpose of our industry in all its conservation work is selfish. There is a sweeping law of life and nature which compels even the most selfish of us to contribute to the common good, and the small incidental profit that any brave investor or engineer can make out of the utilization of the forty or fifty or a hundred millions of water power now going idly to the sea, is as nothing compared with the gain to society if it will but encourage him and foster his efforts.

So much for some of the very large aspects of these figures, but there are others that swing at once into the range of study along other lines, and there we touch again many of the biggest problems and possibilities of the central-station industry, as a reservoir of energy and the chief element in the future for putting the principles of economy to work over very much of this whole vast area of mechanical power. We are finding out that the central station can do much for the street railway as its cheaper source of energy. We have already tied in closely with every branch of manufacturing industry. We have leadership in the world of light. But look at the totals under steam locomotives and automobiles. Let us realize the really enormous opportunities in each, and all of us help bring in the cleaner, sweeter day when both those great domains of power have been electrified by us to the limit.

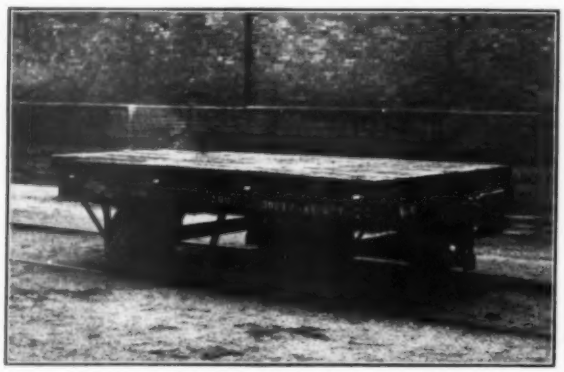
Electrification in Switzerland.

The Swiss Government is providing for the expenditure of $7,600,000 for the electrification of the St. Gothard railway. This will be the first step in electrifying the Government lines.

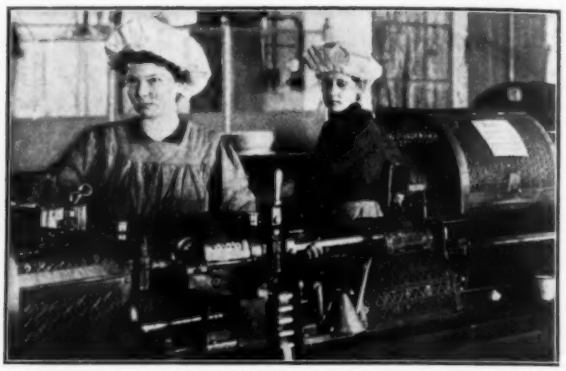
Safety Devices in a German Electrical Factory.

Modern manufacturing methods, humanitarian considerations and legislative enactments, all combine in requiring the provision in the up-to-date electrical works of contrivances for protecting employees against accident. Rules and regulations have been drawn up counselling caution and condemning foolhardiness. Occasionally regulations are ignored or forgotten and familiarity breeds a contempt for devices provided. Much might be written regarding the men who in electric central stations have felt that the rubber gloves and mats or boots intended for their use when handling live apparatus, were unnecessary and have, in consequence, formed the object of a coroner's inquest, and have left a warning to others behind them. This same over-confidence or forgetfullness is often found in manufacturing works and many a workman has found himself in trouble because he has failed to observe the requirements of legislation framed for his own and his fellow workers' protection. Such proceedings serve to remind the operative that he has responsibilities and may incur penalties, though legislation brings legal obligations upon works owners and managers, calling for compensation for the injured and their dependants.

In Europe the movement in the direction of workmen's compensation which began nearly thirty years ago had as one of its most interesting and important results the rise of the science of accident prevention, consisting of the devising of means and measures for avoiding dangers. In Germany an excellent example of what is being done is to be found in the largest electrical works in Europe—the factories of the Allgemeine Elektricitäts Gesellschaft. G. Osenbrügge, the company's social engineer, as he is denominated, has recently delivered a series of lantern lectures describing the principal protective devices that are employed in the company's factories, and in the accompanying series of photographic views we are able to show a number of these. We understand that the safety arrangements in the

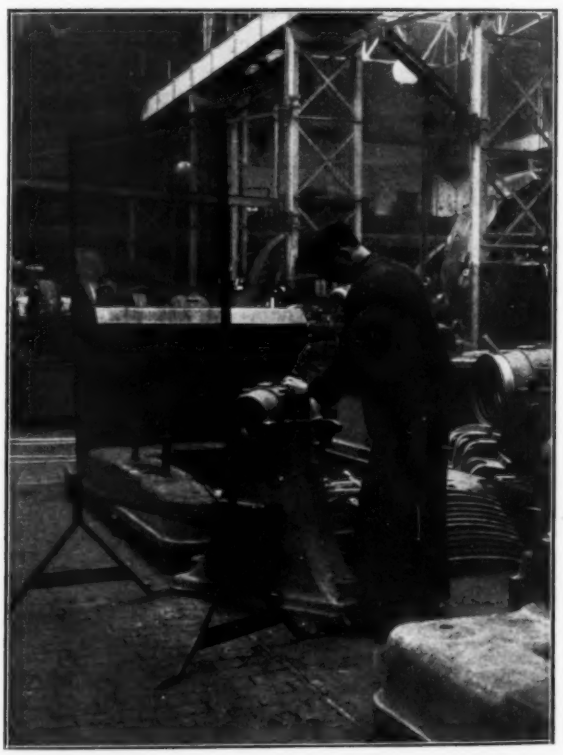


Truck with Protected Wheels.

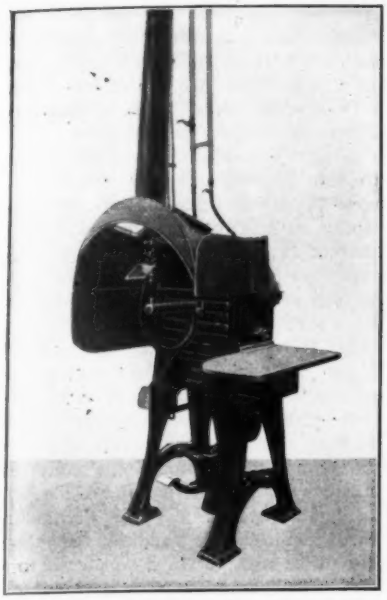


Protecting Headgear—Wrong and Right Positions.

Centrifuge with Double Cover.



Protecting Goggles and Screen for Chisel Work.



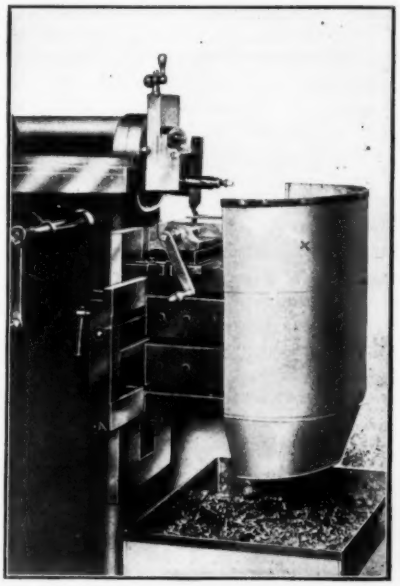
Protecting Devices for Electric Welding Machine.

Allgemeine Elektricitäts Gesellschaft factories are published every month in illustrated, descriptive leaflets which are issued to the various departments. In the factories there is an entire absence of all transmission gear, and each machine is equipped with individual electric drive. Strict regulations control all the railway traffic of the extensive works and yards and the small transport trolleys are fitted with iron frames which inclose the wheels above the rails, thus protecting the workers' feet.

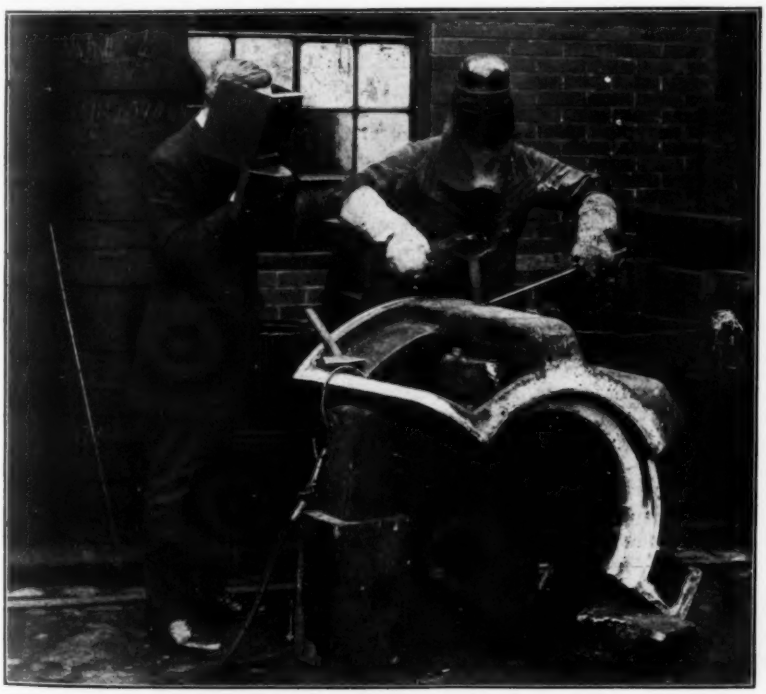
Operators at presses and stamping machines are prevented from placing their hands under the press while the stamping or pressing process is proceeding, by safety apparatus which includes levers for starting the machines which occupy both hands, protecting sleeves which can be pushed together, and other devices. The shaping machines have gratings to catch shavings which fly off when working brittle material. Operators of welding machines are protected against injury from particles of molten metal by a mica screen placed over the electrodes. A hood surrounds the machines to prevent injury being done by showers of sparks. Disengaging devices, connected with the controllers, are led around the entire circumference of the table of large lathes. The premature insertion of the hand in the rotating drums of centrifugals is prevented by the provision of double covers which cannot be opened unless the machines are stationary, or by a single cover connected to a belt-shifting device in such a way that the drum cannot be opened while in use.

For the protection of the eyes, workers with chisels wear protecting goggles, and men employed in autogenous or electric welding are protected by colored glasses, helmets, asbestos gloves, leather aprons, etc., against effects of light and heat. In the caustic works special arrangements are in vogue for drawing off the nitrosulphuric gases through stoneware exhausters, and for the precipitation of the gases in stoneware towers. Ladders attached to vertical walls are fitted with back bars. Washing apparatus for washing metals with benzine is supplied with devices which, if the benzine ignites, allow an extinguishing mass to fall at once or let the lid of the apparatus down.

There are also devices for protection of workers in the grinding department, on slicing lathes and on compressed-air hammers. Rotating parts of machines, such as spindles, shafts, etc., are covered, and protective headgear is supplied for female workers.



Shaper with Shaving Catcher.



Protection of Welding Operators.

Vertical Ladder with Back Bar.

THE RELATIVE POWER REQUIREMENTS OF A MOTOR AND ITS CONTROL EQUIPMENT.

By M. D. Goodman.

Most engineers have a deep-rooted idea that a certain size of motor must always have the same-size starter and controller. True, most applications require the same-size starter or controller; while a number of important applications need a larger or smaller rating for the control equipment than that of the motor in order to insure economic and advantageous operation.

This statement applies more directly to automatic starting equipment in which the power that is to be delivered to the motor is at all times limited. In other words, we refer to the most improved method of current-limit acceleration; and this type of control equipment will be in mind throughout this article.

Some time ago the writer had occasion to make tests on a 15-horsepower, 220-volt, non-reversing elevator motor. The motor had just been overhauled and was in good condition. The elevator mechanism was, however, antique and had an excessive amount of static friction. With the maximum load allowable on the elevator the motor drew about 40 amperes while running. After a 15-horsepower starter had been installed it was found that it would not do the work satisfactorily. The 15-horsepower starter allowed about 90 amperes, or 50 per cent overload, through the motor on the first point. This power would not move the motor and it was immediately decided to find out how much current was necessary. This was done by placing a rheostat in the motor armature and increasing the current gradually until the motor began to turn over. Once the motor started and the static friction overcome, the acceleration was easily accomplished.

It was found that the current required to start the elevator under full-load conditions was about 120 amperes at 220 volts or about 30 horsepower. Automatic controllers and starters for this class of work allow about 50 per cent overload on the first step. Approximately 120 amperes are drawn by a motor through a 20-horsepower starter and this is the size of starter that is installed in this installation and it is giving excellent satisfaction.

The motor is, of course, overloaded, and might under ordinary condition be somewhat larger, but a new motor was out of the question in this case, and the problem was satisfactorily solved by using a 20-horsepower starter with a 15-horsepower motor.

Another instance in which a five-horsepower automatic motor starter had been originally installed was on an air compressor driven by a five-horsepower motor. The motor used was of extremely rugged design as it was recognized that the starting conditions would be severe and the motor had to take care of them. Although the engineers took care to see that a motor was provided to take care of the special conditions, an ordinary five-horsepower automatic starter was provided. Of course, the five-horsepower starter did not allow enough current to flow through the motor to start it up. The solution to the problem was to use the same care in selecting the controller as was given in the selection of the motor. A test was made and a 7.5-horsepower starter was decided necessary for this machine. Numerous machines of this type in operation have attested the merit in this combination for this particular application.

Probably cases are just as numerous in which a smaller size of automatic starter than the motor may be used to advantage. The general class of machines that fall under this head are those that are started with no load or lightly loaded and are not started up very often. If a machine is started under no-load conditions the initial rush of current necessary to set the machine in motion is comparatively small in comparison with the capacity of the motor. Therefore, in some cases it is advisable to use a starter smaller than the rating of the motor. However, care should be exercised in making such a selection, and all the operating and starting conditions should be taken into account.

An instance in which automatic starters smaller than the capacity of the motor have been advantageously applied is on X-ray machines. The motors on these machines never start up under load. The writer is familiar with two companies which use automatic starters between two-thirds and three-fourths the rating of the motors for this class of service and three years of practical experience on hundreds of machines equipped in this way attest their satisfaction. The makers of the X-ray machines obtain two advantages from this arrangement. First, space is an important factor on X-ray machines and the smaller-horsepower starter generally requires less room. Secondly, the cost of the starter is a little less.

Another instance in which a smaller automatic starter than the motor has been successfully applied is in the case of wireless outfits. The motor-generator sets for this work are always started up under no load. The space factor is probably the most important advantage derived by using a smaller starter for this class of work, as these outfits are placed on ships, in which, in many cases, a comparatively small space is available.

Enough examples have been given to show that advantages may sometime be had by using a starter or controller of a different horsepower than that of the motor. Operating advantages are frequently obtained and cost is reduced by using a starter smaller than that of the motor.

On the other hand a starter of a larger size than the motor may prove economical and favorable from an operating standpoint. In cases where starting conditions are severe and running loads are light and the motor is started a comparatively few times, an automatic starter capable of taking care of the heavy conditions may be used with a motor of a smaller horsepower; whereas a motor as large as the starter would ordinarily be used.

Electric Restaurants in Europe.

Another public restaurant was added to the list of those doing business in England this year when the Brompton & Kensington Electricity Supply Company, Limited, arranged for the installation of such a department adjoining its show rooms at 254 Earl's Court Road, Kensington. This restaurant has been fitted up by the Brompton & Kensington Accessories Company and is usually known as the B. & K. restaurant.

The restaurant is equipped for catering to about 100 persons. In planning and carrying out the scheme a policy of "Everything Electrical" has been followed. The buildings are lighted, ventilated, heated electrically; all cooking including breadmaking, also water-heating, refrigerating, cleaning, signalling and time service are electrically done. Every table is fitted with supply of current so that the customers may do their own small cooking operations if they please —using toasters, chafing dishes, etc. Bell pushes on each table are to be pressed, lighting up signal lamps in the service room which remain lighted until the particular table indicated has received attention. The equipment contains various makes of apparatus.

The visitor may pass from the restaurant into the main kitchen, through a separating plate-glass door, and see things for herself—or himself. In this kitchen there is a 70-kilowatt large cooking suite controlled from 58 switches. Nine ovens of various sizes and loadings are in the lower part. Two steamers heat vegetables, fish, puddings and so forth, and adjoining them are ovens for baking bread and rolls. On the opposite side of the steamers is a large fish fryer with a toaster and grill. The main hob car-

ries twelve hot plates of different sizes. Running along the top of this suite there are switch indicator lamps, while below are hot cupboards for silver. Other parts of the equipment in this main kitchen are an electric coffee roaster, a meat chopper, coffee grinder, *bain marie*, fish kettle, stock pot, egg boilers, etc. Hot water for kitchen and scullery requirements is supplied by a Cooper water heater.

On the first floor there is also a small model kitchen with electric stove and in the basement a refrigerating plant serves the cold chamber and makes ice, and a 100-gallon Cooper water heater is fitted. Also in the basement there is a messroom for the 18 members of the B. & K. restaurant staff and the electric installation here can be inspected under working conditions.

In order to cope readily with all requirements from the district in the matter of apparatus, there is a workshop for dealing with cooking and heating appliances, and another feature of the B. & K. aggressive policy, not so usual as it ought to be in England, is facility for charging electric vehicles.

In the main restaurant there is a large double grill, also a carving table and hot cupboards. There are hot plates fitted throughout to insure food being served up properly heated. The servery lies at the back of the main restaurant and is fitted up with tea and coffee urns, etc. The total load of the equipment is given as equal to 140 kilowatts.

Simplex Conduits, Limited, has equipped an electric kitchen for the use of its office staff in Birmingham; 40 meals are prepared per day, consisting of soup, two kinds of meat, a choice of desserts, coffee, etc., and in addition some 60 teas per day. The average cost of cooking per person per meal has been found to be a little more than one cent, the price of energy being two cents per kilowatt-hour.

In the Siemens-Schuckert Company's cable works, near Berlin, Germany, an electric kitchen capable of providing for 200 to 300 persons was installed in 1911. The equipment includes eight saucepans of 31 quarts capacity, consuming 4.2 kilowatts each; eight 13-quart 2.6-kilowatt saucepans, and one of 5.3 quarts capacity (1.5 kilowatts); 10 pans totalling 16.6 kilowatts demand; one 2.6-quart kettle (one kilowatt); one copper kettle and one coffee urn each of 31 quarts capacity; and one combination containing two roasting ovens, and two hot chambers (15 kilowatts). The maximum demand is 93 kilowatts, but the average lies between 20 and 40 kilowatts.

During one month (August) it was found that the average energy consumption per meal (of one-half pint soup, 6.5 ounces meat, 5.5 ounces of potatoes, 2.5 ounces of other vegetables, 0.075 pint milk and 0.42 pint coffee) was 0.394 kilowatt-hour. With energy at one cent per kilowatt-hour, electric cooking saved 10 per cent, as compared with the gas cookers used in the old cable works, but even with current at two cents or more per unit, the higher cost of electric cooking is far outweighed by the incidental advantages secured.

The North German Lloyd Company has electrified the kitchen at its offices in Bremen, Germany. Meals are cooked here for 500 employees, who dine in groups at one-hour intervals. The electrical equipment consists of five saucepans and five steamers, each of 44 quarts capacity and 6.5 kilowatts consumption; five 17.5-quart saucepans (three kilowatts each), two of 13 quarts (2.6 kilowatts) and two of nine quarts (two kilowatts) capacity; four 14-inch steel pans (2.4 kilowatts each); three 70-quart kettles (eight kilowatts); two 44-quart copper kettles (5.5 kilowatts each); one combination containing four 30-by-11-inch roasting ovens (28 kilowatts); two hot cupboards each with four divisions (four kilowatts each); three hot plates each with two heats (four kilowatts each); two heating tubes for the warm-water tank (six kilowatts each). The maximum possible demand is 194 kilowatts and the average 40.6 kilowatts. Electrical energy is secured here at a cost of about 0.6 cent per kilowatt-hour.

The saucepans or boilers are double-walled, nickel-plated and provided with side and bottom heating elements. The heaters are of pure nickel, or 20-per-cent nickel-plated, and the vessels being in one piece, there are no joints to melt should they be allowed to boil dry. The various heating elements are connected in series-parallel and, according to the switch setting employed, 6.5, 3.7, 2.8 or 1.7 kilowatts may be expended in each 44-quart saucepan. The lowest heat (all elements in series), is employed to complete cooking after boiling point has been reached (55 minutes from cold, using full heat).

The hot cupboards (for crockery and cooked food, etc.) and provided with inclosed heating elements beneath the shelves, which are readily removed. Each section requires one kilowatt (maximum) and heating is regulable in three stages; 100 degrees centigrade can be reached from cold in 40 minutes on full heat.

For the preparation of sauces and small quantities of special dishes, three double hot plates are provided. Each consumes two kilowatts and is heated by six silundum rods mounted beneath a slotted grid.

Two 44-quart (5.5 kilowatts, regulable) copper kettles are mounted in a window recess, and from them boiling water is led into a coffee percolator. The prepared coffee is kept hot for as long as may be necessary by electric heat.

A 220-gallon tank erected above the kitchen supplies all the hot water required for cooking and washing purposes, at 60 degrees to 80 degrees centigrade. This is provided with a worm, and the original coal-fired circulating heating system is now replaced by two six-kilowatt electric circulator hot tubes mounted immediately below the ceiling, and rendering available for other purposes the space occupied by the original coal-fired boilers.

In a recent bulletin issued by the Allgemeine Elecktricitäts Gesellschaft, Berlin, Germany, and dealing with electrically heated cooking apparatus for factory lunch rooms, barracks mess halls, sanitaria, etc., there are given some interesting data obtained after 15 months' use of this method in the lunch room of an up-to-date German factory. Abundant electrical energy was available and simple, wholesome meals were cooked in considerable quantity; the average number of persons provided for was 130.

The electrical cooking equipment comprised seven kettles, each provided for three heats and ranging in capacity from 10 to 150 liters (2.6 to 39.6 gallons); their power consumption at high heat ranged from 2.2 to 12.0 kilowatts, respectively. There were also two warming ovens, two roasting pans and several small sauce pans. In the following table covering a year's operation, is given by months the number of persons served or the number of individual meals cooked, the weights of meat, potatoes and other vegetables cooked (one kilogram equals 2.2 pounds), the quantity of soup prepared and water heated (one liter equals 0.2642 gallon), the total electrical energy consumption and the energy consumption per person per month and per day.

DATA ON ELECTRIC COOKING.

Month	No. of Persons	Meat Kilogram	Potatoes Kilogram	Vegetables Kilogram	Soup Liter	Hot Water Liter	Total Kilowatt Hours	Kilowatt Hours per Person per Month	Kilowatt Hours per Person per Day
April	2,667	310.0	1,125.0	48.5	650	1,398	994.7	8.216	0.35
May	2,808	443.5	1,162.5	82.0	670	1,541	1,150.3	9.514	0.41
June	2,851	368.0	1,187.5	69.0	665	1,625	1,196.9	10.867	0.43
July	3,298	441.0	1,375.0	47.0	820	1,548	1,425.3	11.681	0.43
August	3,276	415.5	1,350.0	49.0	805	2,183	1,295.6	10.740	0.39
September	3,098	407.5	1,275.0	98.5	750	1,461	1,272.1	10,284	0.41
October	3,306	432.0	1,362.5	105.0	840	2,403	1,395.4	11.165	0.41
November	3,074	371.0	1,250.0	109.0	780	1,741	1,224.7	9.977	0.39
December	2,505	296.0	1,075.0	46.0	620	2,431	986.0	8.245	0.39
January	2,933	357.5	1,290.0	109.5	765	1,737	1,257.3	11.194	0.43
February	2,898	338.5	1,177.5	78.0	720	1,668	1,255.6	10.496	0.42
March	2,516	294.5	1,100.0	69.0	635	1,427	1,016.1	9.112	0.41

From the table it is found that the average electrical energy consumption per person per day was a trifle over 0.4 kilowatt-hour. At a cost of two cents per kilowatt-hour this amounted to only 0.8 cent per individual meal.

Electric Iron-Ore Smelting in Sweden.

A Swedish expert points out a few misunderstandings, and gives some additional information about this interesting subject. The common statement that Sweden's raw material for good charcoal —that is, a sufficiency of suitable trees —is so much on the wane that it will deteriorate the quality of Swedish pig iron, is not correct. The size of the electric smelting furnace is being increased, but the conical shape is not superseding the cylindrical. A conical furnace has been built; in this type, however, which requires somewhat less material in the way of bricks, but, on the other hand, involves a somewhat more expensive iron construction, the smelting process is exactly the same as in the cylindrical type. The conical furnace, therefore, must be looked upon as an experiment, and not as a final adoption.

At Hagfors there are three furnaces of 3,000 horsepower working, and the Uddeholm Company has decided to build two more furnaces, but whether at Hagfors or Nykroppa has not yet been finally settled.

Failing a sufficiency of large water falls conveniently located (and a furnace with 6,000 tons annual production requires about 3,000 horsepower), the electric energy can probably with advantage be generated by means of peat or peat-dust, which is a cheap commodity on the spot and does not require an expensive plant. In addition there is available the special Hoganas process, with reference to which only scanty particulars so far have been made available.

It is undoubtedly correct that the Swedish electric furnaces have given favorable results in every respect, yielding a product which, in the matter of quality, excels that obtained by the old method, on account of the adjustable percentage of carbon, the smaller percentage of phosphorus and sulphur, the possibility of using ore containing titanium, or ore difficult to reduce, the continuous working, the satisfactory durability in the furnaces and the small consumption of electrodes. In addition, the saving in wages, etc., amounts to about 85 cents per ton.

Another favorable circumstance of electric ore smelting is the facility with which the gas produced in the furnace, after aiding to reduce the ore, can be used as a source of heat; two furnaces of 6,000 tons capacity supply the heat requirements of a Martin furnace, representing an annual saving of $4,000.

The working at Hagfors has in every respect turned out satisfactorily. With Central Swedish ore, containing 55 to 60 per cent of ferrum, the charcoal consumption of 40 to 42 per cent being done away with, other items, with decreased wages bill, coming into play also, the aggregate saving per ton works out at $6.10. Against this there is to be put:

	Per Ton Pig Iron.
One-third horsepower at $11.25 per year	$3.75
Electrode consumption, not above	.55
Total	$4.30
Or a saving of	1.80

According to this the electric smelting of iron ore (apart from the higher quality) should be commercially possible at a price per horsepower-year of $16 instead of $11.25.

The Uddeholm Company, which possesses its own waterfalls, estimates the cost of installation at $800,000 for 10,000 horsepower, and a further $286,000 for an additional 100,000 horsepower; consequently making $57 per horsepower, which, reckoning 12.5 per cent per annum for interest, sinking fund, and maintenance, comes out at $6.70 per horsepower on the first cost.

An electric furnace of 6,000 tons capacity entails a cost of from $76,000 to $80,000, the cost of production per ton of pig iron being about:

One-third horsepower at $11.25	$ 3.75
Cost of furnace	.34
Electrodes	.54
2 tons of ore containing 55 per cent of iron, at $2.68	5.37
20 hectoliters (about 70 cubic feet) charcoal	3.22
Flux	.54
Management anl labor	1.34
Total	$16.10

In 1910 Sweden produced 890 tons of electric pig iron, and, in 1912, 17,566 tons; the increase is to some extent attributable to the experience gained in working by both the officials and men.—*Engineering.*

Large Reservoir for Irrigation and Generating Electricity.

A bill has been passed by the Italian Parliament for the construction of extensive reservoirs and hydroelectric works. The contemplated construction work in Calabria will require the erection on a grand scale of three dams at an estimated cost of some $13,000,000 and is expected to supply in the aggregate about 150,000 horsepower of electric energy, intended to be utilized for traction, illumination, and the development of industries, not only in Calabria, but also in Apulia and throughout southern Italy in general. These works are also for irrigation.

Proposed Municipal Plant for South Vancouver.

The council of the municipality of South Vancouver, B. C., has unanimously passed a resolution calling for establishment of a municipal electric plant. The report of the municipal electrician provided for constructing an electric light and power plant at a cost of $600,000, being $400,000 for the first unit and $200,000 for the second unit, not including cost of the building, with a capacity capable of supplying the needs of the district for the next five years.

A schedule of proposed rates calls for seven cents per kilowatt-hour for light and two cents per kilowatt-hour for power on the day load. The report recommended a two-unit steam generating plant with turbogenerators having a nominal rating of 2,000 kilowatts and a maximum rating of 2,500 kilowatts, with crude oil as fuel. Provision was also made in the estimate for an adequate system of street lighting, including 300 arc lamps and standard lamps for the principal sections.

It was estimated that there were over 8,000 electric light and power connections in South Vancouver, and a large number of the dwellings at present are not using electric light. The city at present obtains its light from the Vancouver plant of the British Columbia Electric Railway Company.

Calcutta Electrical Engineers Organize.

The electrical engineers in Calcutta, India, have formed a local section of the Institution of Electrical Engineers, of Great Britain, R. Winkfield, a leading engineer of that city, has been elected the first chairman. At the inaugural banquet Mr. Winkfield said: "There is a very large future for our work here. In that future the lights and fans we have so far dealt with almost entirely will become (comparatively) a negligible quantity. The bulk of supply will be for motors and transport. The Calcutta Electric Supply Company at present has connected to its system over 40,000 fans, 370,000 lights, and 1,096 motors, the latter varying from one horsepower to 250 horsepower in size."

Enlargement of German Central Station.

The Kraftwerk Stettin, the company which furnishes electric current to the consumers in Stettin, Germany, and vicinity, is erecting a second plant, in order to supply the constantly increasing demand. Machinery of 12,000 to 15,000 horsepower will be installed at once, but the plans are so arranged that it can be increased to 50,000 horsepower. When completed, Kraftwerk Stettin will be one of the largest central stations in Germany.

BOOK REVIEWS.

"Advanced Shop Mathematics." By Earle B. Norris and Ralph T. Craigo. New York: McGraw-Hill Book Company. Cloth, 214 + xxi pages (6x9 inches), 218 illustrations. Supplied by the Electrical Review Publishing Company for $1.50.

This volume presents the second half of the instruction papers in shop mathematics as developed and used in the Extension Division of the University of Wisconsin. In it the authors have presented the essential principles of algebra, geometry, trigonometry and logarithms. The work is very well written in a clear and simple style that appeals to the shop student. The applications have been selected with great care, showing that the authors have a first-hand familiarity with shop problems.

Chapters I-VII include a very satisfactory discussion of the important topics in elementary algebra. Formula work is given adequate treatment as this is most essential to the technical man from the standpoint of writing a formula to apply to a problem as well as in its transformation after formulation. Chapters VIII-IX serve to bring to the student's attention the importance of graphic representation of formulas and the pictorial display of tables and statistical data. Chapters X-XIII present the fundamental facts for making the usual geometric constructions and their applications to concrete problems. These chapters include also the mensuration formulas for regular and irregular figures. Chapters XIV-XVIII present the basic element of trigonometry with an extensive range of applied problems. The work is completed with Chapters XIX and XX involving the theory of logarithms and their applications. Four-place tables of logarithms and natural functions are inserted in the text and these serve for the computation of any practical problem.

It is regretted that the authors have not seen fit to include a short chapter on the slide rule. The captions for paragraphs 46 and 47 are misleading. The book seems notably free from errors. The authors are to be commended for the excellent arrangement of the material of the book and for its lucid presentation. They have avoided padding with extraneous tables of weights and measures and unnecessary engine cuts which belong to other works but which have been introduced recently into textbooks of this character. The publishers have set an excellent piece of press work. The book is teachable as well as serving for self instruction. It meets genuinely the demand from industrial students and therefore is to be recommended highly for use as a text in trade schools, technical high schools and continuation schools. It serves as an excellent preparation for more advanced technical study and its contents are part of a necessary equipment which should be possessed by every candidate applying for admission to technical institutes.

E. H. Koch, Jr.

"Application of Electric Power to Mines and Heavy Industries." By W. H. Patchell. New York: D. Van Nostrand Company. Cloth, 333 pages (5½x8¾ inches), illustrated. Supplied by the Electrical Review Publishing Company for $4.00.

American mining men will be interested in Dr. Patchell's very complete résumé of British electrical mining practice, and will perhaps be surprised to find American practice comparing favorably in many respects. Dr. Patchell naturally describes the latest and best of the British plants, and it is apparent that, in many instances, larger investments are made for the sake of minor gains in efficiency than would be approved in this country, with our low acreage costs, cheap power, and uncertain car supply and trade conditions.

The subjects treated, in addition to a chapter on general considerations, are as follows: Cables, Coal Cutters, Haulage, Hoists, Ventilation and Air Compressors and Pumping, in addition to which are chapters on Electrical Driving of Rolling Mills, Machine Tools and Cranes, Electric Welding and Electrical Furnaces. These latter chapters are very comprehensive reviews of the latest examples and progress in the subjects mentioned, with, of course, particular reference to British practice, although brief reference is made to Gary, Ind., and Algoma, Ont.

The subject of cables, etc., is treated at length, owing to the stringent British rules, which practically require armored cables for underground work, and the various insulating materials, methods of construction, etc., are compared. We do not find varnished-cloth insulation mentioned, though mechanically and electrically this material is found most serviceable in this country.

Coal cutters described are practically all designed for longwall work, which is rare in this country. The so-called shortwall machines in America, which have had such phenomenal success, were developed from the longwall machines.

Electric haulage refers entirely in this work to motor-driven rope haulages, as locomotives are not used underground in Great Britain. This section contains valuable data on gearing, including the Wuest herringbone type, which has been so well received in America. The subject of winders, or electric shaft hoists, is also very fully treated, with numerous illustrations and examples. American development along this line has been slow until within the last two years, in which time many large installations have been made.

Electric drive for ventilating fans is treated at length, with especial reference to variable-speed induction-motor drive, some forms of which, such as the Scherbius system, are making considerable headway in America.

The figures given on track resistance of mine wagons are surprisingly high, and tend to confirm my opinion that the superiority claimed for electric equipment of foreign mines is all on the surface. It is a fact that their underground conditions in general, both in British and German collieries, would not be tolerated in large American mines. Our almost universal use of locomotive haulage has in a way forced the improvement of roads, tracks and wagons to a degree far beyond foreign practice.

The book is well printed and unusually well illustrated, with a number of useful tables, charts, etc. Dr. Patchell's adherence to British units requires translation from British thermal units to kilowatt-hours and horsepower for American readers. The work will in general be found valuable and interesting to electrical mining engineers and superintendents.

George R. Wood.

"Transformer Practice." By William T. Taylor. Second edition, rewritten. New York: McGraw-Hill Book Company, Incorporated. Cloth, 271 pages (6 x 9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.50.

The preface indicates that the book is intended particularly for the use of operators and engineers who have to do with the installation and operation of transformers. The greater portion of the text deals with various transformer combinations, including constant-potential transformers, series transformers, regulators and connections for testing out. The field is well covered and includes practically all available combinations. This feature of the book makes it of value to anyone interested in transformer connections. The introduction is too brief to give justice to the development of transformer construction, with the result that some statements by the author are not as explicit as they might be.

In the chapter on specifications the author recommends a set of detail specifications, which are, in effect, construction specifications of the transformer instead of performance specifi-

cations. It is very difficult for a consulting engineer or a purchaser of a transformer to determine the relative merits of the different makes of transformers by comparing the physical dimensions of the various parts. Far better results are obtained by a comparison of the performance and radiation constants. The binding and printing of the book are good and very few typographical errors appear.

E. A. WAGNER.

"Overhead Electric Power Transmission." By Alfred Still. New York: McGraw-Hill Book Company, Incorporated. Cloth, 310 pages (6 x 9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $3.00.

This book supplements Mr. R. A. Lundquist's work on "Transmission Line Construction," by giving the theory underlying transmission-line calculations. In this respect it fills a gap that has too long existed in technical literature. Although the book is mainly theoretical, the treatment is such as to appeal to the practical engineer. It is also an excellent textbook for college classes in power transmission, although for this purpose, some of the sections are not as clear as they might be. The scope of the book is indicated by the chapter headings and appendices,which are: Introductory and General, Principles and Theory-General, Economic Principles and Calculations, Electrical Principles and Calculations, Insulation and Lightning Protection, The Transmission of Energy by Continuous Currents, Mechanical Principles and Calculations, Transmission Line Supports, Inductance of Electric Transmission Lines with unsymmetrically Disposed Conductors, Inductance of Electric Transmission Lines as Affected by Subdivision of the Circuit and the Arrangement of the Conductors, Two-Phase Transmission with Three Conductors, Approximate Method of Determining Deflections and Stresses in Flexible Tower Lines, Graphical Statics Applied to Transmission Line Calculations, Sample Specification for Wood Pole Transmission Line, and Sample Specifications for Steel Tower Transmission Line.

The chapter on Economic Principles and Calculations is worthy of special mention as in this the author clearly points out the influence of the various factors in securing economic construction and gives some illustrative examples in evaluating the various quantities. The significance of Kelvin's Law for minimum section of conductor is explained and a practical method of applying it is shown. It seems to the reviewer unfortunate, however, that the author seemed to think it necessary to base his formulas on pages 48 and 49 on the cost per horsepower instead of on the kilowatt-hour. As it is becoming customary to use 1,000 feet as the standard of length, this unit should have been used in place of the mile; likewise the use of the Fahrenheit scale in an electrical engineering text seems inconsistent.

The subject of continuity of service is of such importance that methods of securing this deserve full discussion. To the reviewer the discussion of the arcing-ground suppressor is inadequate. In describing the transmission of energy by direct currents the author has departed considerably from the title of the book by giving quite detailed information concerning the manner in which direct-current machines, both generators and motors, are connected and disconnected. This explanation is interesting and its inclusion is undoubtedly justifiable by the indifference shown by American engineers toward this method of long-distance power transmission. The author points out many advantages of power transmission by direct currents.

The mechanical principles and calculations of transmission lines are quite fully outlined, although part of the material is placed in an appendix. This does not exactly meet the approval of the reviewer, who believes that if the matter is of the same nature as that of the main portion of the text, it should be correlated and placed with the other matter of like nature. This of course is merely a matter of preference and does not detract from the many excellent qualities of the book.

It is impossible to point out specifically the separate good features, but the writer believes that the author has succeeded in preparing a most useful book for not only the practical designer of transmission lines, but also for the engineering student who wishes to acquire a knowledge of the scientific principles underlying transmission-line construction.

C. M. JANSKY.

"Electric Light and Wiring." By George J. Kirchgasser. Milwaukee: Electroforce Publishing Company. Limp leather, 274 pages (3 x 5¼ inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.00.

The author has written this pocket-book on electric light and motor wiring with the definite idea in mind of producing something that would be of a very practical nature. The style and scope indicate the author's particular knowledge of the requirements of the field he caters to, and the book will be of the greatest usefulness to electricians, inspectors, superintendents of construction, electrical contractors, and, in fact, everyone who has to either install or supervise the installation of electric light and motor wiring. The book describes just what the different systems of electrical wiring are, how they are installed and the National Electrical Code requirements regarding them. Many illustrations and diagrams are used to facilitate understanding.

Wireless Progress.

The new receiving station of the Marconi Wireless Telegraph Company at Louisburg, Nova Scotia, is now in operation. It is situated about 10 miles from the transmitting station at Glace Bay. In Ireland a new receiving station has been erected at Leterfrack, about seven miles from the sending station at Clifden.

The operation of this duplex system will not only add greatly to the capacity of the stations, but it will be possible for an operator to ask to have a word repeated without breaking in on the transmitting operator. Disturbance between the sending and receiving aerials is obviated by using directed aerials having the shape of an inverted letter L.

The first commercial message handled by wireless between America and Asia was transmitted on October 27 by the United State Signal Corps at Nome, Alaska, to the Russian station at Anadyr, Siberia. This message originated at St. Petersburg and was from the Russian Government to Commander Wilkitsky, who is exploring in the Arctic region.

British Colonial Wireless Stations.

Postmaster General Samuel, of Great Britain, has announced that he is prepared to consider applications for bids for the construction of the second of the three high-power wireless stations of the Imperial chain from any company which satisfies him by practical demonstration of the efficiency of its system. The three stations referred to are those in India, South Africa and Singapore. The contract with the Marconi Company gives the Postmaster General power to introduce any other system at these stations provided their superiority to the Marconi system in efficiency is shown.

Electric Control of Bridges.

H. R. Fowler, of the Fowler Electrical Supply Company, gave an interesting informal talk on November 7 before the Toledo Section of the American Institute of Electrical Engineers, taking for his topic "Electric Control of Bridges." Mr. Fowler showed in simple manner the general practice in the control of bridges, describing the mechanism used for little bridges and big bridges. The meeting wound up with a trip to the new Cherry Street bridge, now under construction, where the bascule lift was inspected and explained by Mr. Fowler.

New Electrical and Mechanical Appliances

Laurent-Cherry Pulley Blocks.

The principles and the advantages of using pulleys or tackles for lifting or hauling heavy loads are well known to all who have made an analytical study of mechanics or who from experience have learned how to utilize them. It is generally known that an ordinary double block increases the pulling or lifting power of a man four times and a triple block six times, but in each case there is lost in overcoming friction from 40 to 60 per cent of the power gained. Thus a man exerting a strength of 100 pounds can pull or lift from 200 to 300 pounds by means of a double or triple block. These limitations of the power of such a block usually necessitate having several or even a large number of men pull on the rope in order to move very heavy loads where steam or electric power is not available.

Fig. 1.—Laurent-Cherry Pulley Block.

On shipboard the capstan has proven a compact and simple means of applying a very heavy pulling force on a single rope or cable; its leverage is dependent only on the length of the capstan bars. Seeing the advantages of the capstan and also the limitations of the pulley block, it occurred to some bright men of the "City of Brotherly Love" to combine the two and thus utilize the force of both these mechanical appliances in a single one. This has ingeniously been done in the Laurent-Cherry pulley block illustrated herewith.

In this block a small capstan is attached to the head block in such a way as not to interfere with the use of the block for ordinary purposes. By applying a pull of only 10 pounds on the lever it is possible to lift or pull 200 to 300 pounds. By exerting more nearly his full strength one man can with this device lift or pull 1,800 to 2,400 pounds. This is accomplished by means of the lever, which, when a heavy strain is encountered is inserted in the ratchet piece. By working the lever back and forth the capstan is rotated, drawing in the rope with such force that one man can pull more in this way than a half dozen men could by pulling on the rope. A set of four concealed dogs engage teeth in the shell of the block which hold the load in any position. In order to slack the load off, the rope is eased and allowed to slide back over the spool. It will thus be seen that an even steady strain can be applied and that no slack that is gained is lost. Fig. 2 shows how the block is used.

Fig. 2.—Using the Lever on the Capstan of the Block.

The Laurent-Cherry block is made in three sizes, of which the smallest weighs only three pounds and is suitable for lifting up to 500 pounds. The second size weighs 14 pounds and can lift as high as 1,500 pounds; it uses a one-half-inch rope. The largest size has a capacity of 4,000 pounds and yet weighs only 27 pounds; a five-eighths or three-quarter-inch rope is used with it.

The many uses for this block are too numerous to mention. Linemen find it particularly valuable for pulling up cables, messenger and guy wires, and in all overhead construction work. Fig. 3 shows one man easily tightening a heavy back guy for a pole. Ordinarily the entire line gang would be required to drop its individual labors to combine in pulling up such a guy. For interior work electricians find this block useful in moving motors and other heavy machinery, for pulling heavy wires and cables through conduit, etc. In a large plant in the East two electricians easily pulled in a 1,500,000-circular-mil cable through a 2.5-inch conduit with three ells; this job would have required six or more men working with ordinary triple blocks.

Fig. 3.—Tightening a Heavy Back Guy with the New Block.

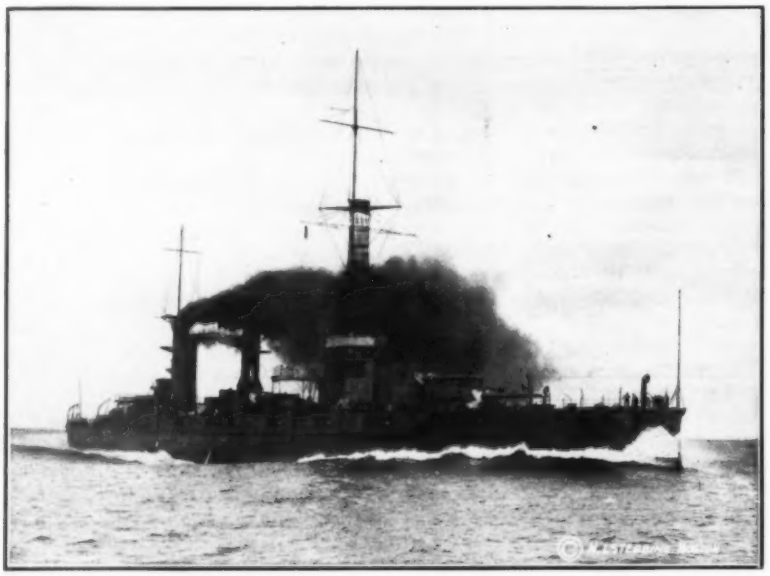
These improved blocks are made by the Laurent-Cherry Pulley Block Company, Philadelphia, Pa.

Half-Watt Tungsten Lamps Being Sold in Germany.

For over a month already several makes of the new nitrogen-filled or half-watt tungsten lamps have been on the market in Germany. These are made by the Auergesellschaft and the Allgemeine Elektricitäts Gesellschaft. These new lamps have an efficiency in all cases of one-half watt per mean hemispherical Hefner candlepower and are made in four sizes, 600, 1,000, 2,000 and 3,000 candlepower. The lamps give equally good results on direct-current or alternating-current circuits and have an average life of 800 hours. No similar lamps are yet on the market in the United States.

Arrow E Snap Switches on the World's Biggest Battleship.

The Argentine Republic's new battleship, the *Rivadavia,* is said to represent the last word in battleship construction and equipment. In recent speed trials off the coast of Maine it proved to be faster than any ship in the United States Navy, and all save one British battleship. It was built by the Fore River Ship Building Corporation to maintain a contract speed of 22.5 knots per hour. In a five-mile trial run the *Rivadavia* made 22.567 knots. The only better record established is that of the British battleship *Neptune,* which on trial has made 22.7 knots. The United States ship *Delaware,* on trial, made 21.56 knots. A sister of the *Rivadavia,* the *Moreno,* will be launched within the next few weeks. The displacement of these battleships is 500 tons greater than any of our battleships, although the *Pennsylvania* and the *No.39,* not yet in commission, will have a greater displacement.



The "Rivadavia," the Largest Battleship in the World.

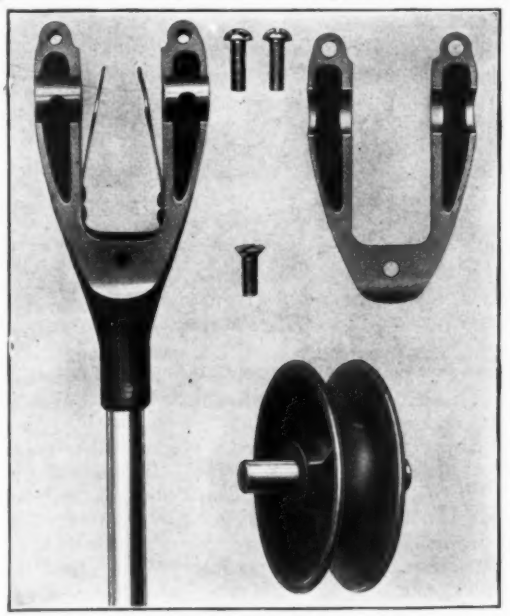
Arrow E Switch for Use on the Battleship.

The Arrow Electric Company, Hartford, Conn., has supplied 3,000 Arrow E snap switches on both the *Rivadavia* and the *Moreno.* These are installed with special weatherproof and waterproof rubber-gasketed boxes and were selected after passing severe tests.

A New Trolley Harp.

A new trolley harp, embodying some distinctly novel features in design, has been added to the Western Electric Company's already extensive line of electric railway supplies. The new design, known commercially as the M-B trolley harp, is a radical departure from the former standard type which made use of a graphite bushing.

New Trolley Harp.



Trolley Harp Disassembled.

The harp proper is made in two parts with two steel wheel bearings set in a recess and held in place by steel dowel pins. Both halves of the harp are provided with chambers for holding the lubricating devices. This consists of a wool yarn packing or oil wick which is saturated with heavy motor oil. To insure thorough lubrication, a slot is cut in the steel bearings so that the wheel spindle may come in contact with the oil wick. The chambers have sufficient capacity to hold a week's supply of lubricant. To replenish the oil supply, it is only necessary to press the point of the oil can against the spring cheeks located on the top part of the harp.

The trolley wheel is equipped with a bronze axle. This axle is sweated into the hub which takes the place of the old graphite bushing. The combination of the bronze spindle or axle and the steel bearings is calculated to lengthen the life of the wheel to a considerable extent. Another excellent feature of the design is found in the fact that the tension of the trolley base keeps the wheel spindle resting on the bottom of the steel bearings. This has been found to aid greatly in reducing vibration to a minimum and in increasing the conductivity. Furthermore, current is not conducted through the spindle or bearings, but is collected by strong bronze contact springs.

Several hundred actual service tests were made before the new trolley harp was finally declared ready for the market. These tests covered a period of over three years and have given an average of over 10,000 miles for the harp used in conjunction with the standard four-inch wheel. The new design, with its various features which insure long service life, is particularly adapted to high-speed work and is therefore also desirable for both urban and interurban use.

Elastic Steel Automobile Tires.

The local press of Valencia, Spain, recently contained an account of an invention which is about to be tested under Spanish military auspices. It consists of an automobile wheel made of steel, with steel tires, which is said to be elastic and flexible, with most of the advantages and few of the disadvantages of the rubber-tired wheel. The novelty is in the construction of the tire, which is composed of a number of equal parts or arcs with sharply beveled ends, each of which makes a flush joint with its neighbor. These segments rest on and are attached to strong elliptical springs whose resistance and flexibility are mathematically calculated, as is also the thickness and surface of the tire. The interior of the wheel is cast solid and provides necessary anchorage for the tire and springs. The tire is designed especially for use on motor trucks.

The cost is said to be only 75 per cent of the pneumatic or solid rubber-tired wheel, and the weight 50 per cent. As regards durability there is no comparison, as the steel tire will last indefinitely. Other advantages claimed for the invention are that it has greater resistance than rubber tires; that the steel tire is perfectly elastic at all points; that the flexibility of the tire can be altered to accommodate varying loads; that it can be used on all vehicles regardless of the load to be transported and the flexibility of the tire will be proportional to the weight of the cargo; that it is not affected by heat or cold or by the condition of the roads; and that it does away with all accidents caused by tire troubles, and can not be easily damaged, while all repairs can be easily and quickly made at an insignificant cost.

Largest Generating Units in Europe.

The first of two 20,000-kilovolt-ampere turbogenerators has just been installed by the Allgemeine Elektricitäts Gesellschaft in the Oberschlesische Elektricitäts Werke power station at Cozrzow, Upper Silesia, Germany. It operates at 1,000 revolutions per minute and generating at 6,000 to 6,500 volts the current is 2,000 amperes, and this is taken through eight three-core cables direct to a group of auxiliary busbars. These are connected to the main busbars by three automatic oil switches in parallel, as it was thought inadvisable to deal with so large a current with one oil switch. These switches have reverse-current relays, but not overload relays, and are operated simultaneously by remote control. Ammeters are connected in each switch circuit, so that any inequality in the division of the current can be detected. The generator is paralleled on one of three switches. Any one can be inspected and repaired without taking the generator off the load, by opening the isolating switches on either side of that particular switch.—*Electrical Engineering*, London.

The World's Largest Precision Testing Machine Installed in Bureau of Standards.

The illustrations show views of the testing machine that has recently been installed at the Bureau of Standards, Washington, D. C. This machine is used for testing columns, blocks, beams, girders, and other shapes of steel, iron, wood, concrete, reinforced concrete, etc., in order to determine the breaking strength, the spring under load, and other valuable engineering data. It is able to take specimens of any length up to 34 feet, and can exert a pull of 1,150,000 pounds, or a crushing force of 2,300,000 pounds, and yet so delicate is it that the pressure of a finger upon it will be registered.

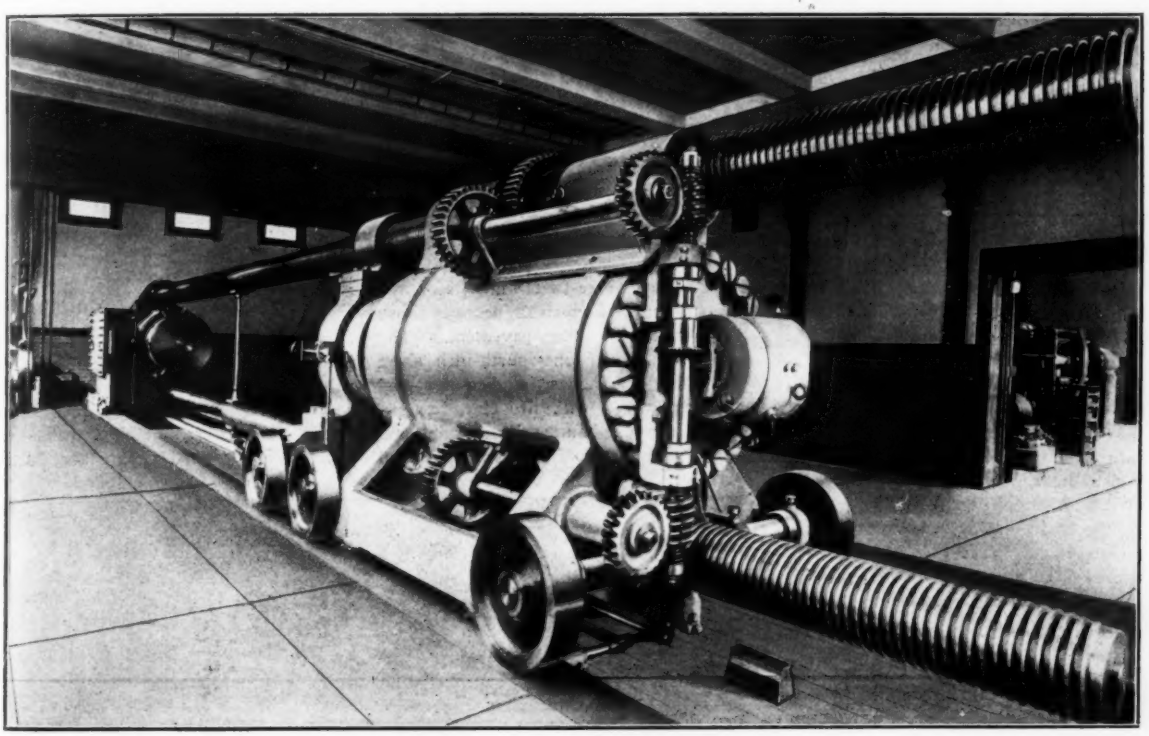


Fig. 1.—2,300,000-Pound Testing Machine in Bureau of Standards.

The machine consists of two main parts connected by two enormous screws. One part (the farther one in Fig. 1) is stationary and contains the mechanism by which the force exerted on the specimen is measured. The other part, called the press, is movable and consists essentially of a hydraulic cylinder mounted on wheels. It will be noted that the head of the hydraulic piston is mounted on wheels of its own and can move independently of the cylinder. The oil, which is used to produce the hydraulic pressure, is supplied through a pipe which telescopes or elongates as the press is moved.

In testing, the press is moved to the

proper point, depending on the size of the specimen, by the Westinghouse motor seen in the photograph. The specimen is then put in place, being gripped by the jaws mounted on each of the ends of the testing machine, if it is to be put under tension, or held between two heavy plates, if it is to be compressed. The hydraulic piston is then slowly forced forward or pulled back, depending on whether the test is of compression or tension, until the specimen under test is ruptured.

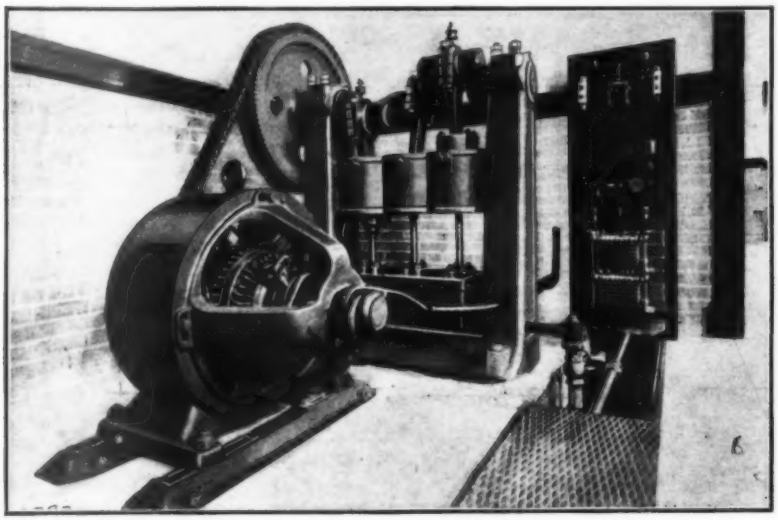


Fig. 2.—Motor-Driven Oil Pump for Testing Machine.

Fig. 2 shows the Deane pump driven by a 20-horsepower Westinghouse motor which supplies the oil for operating the hydraulic cylinder. This pump is capable of delivering oil at a pressure of 3,500 pounds per square inch.

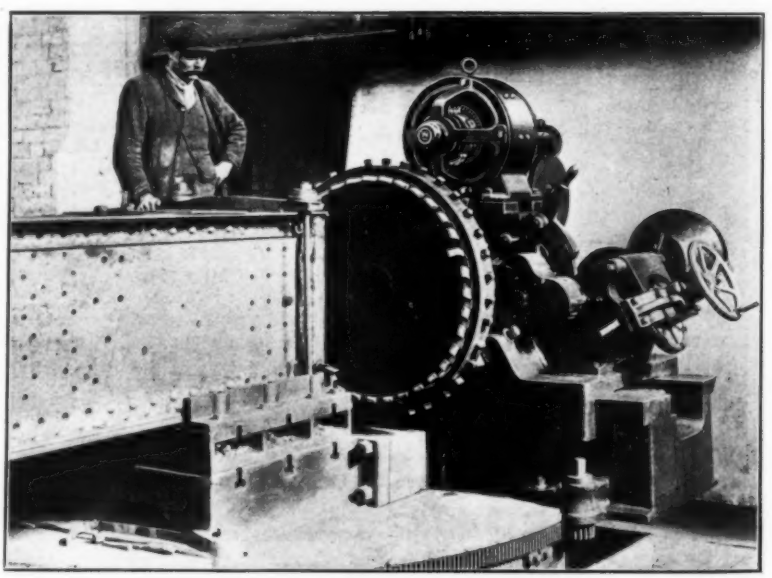
A Mexican Process for Reinforcing Rusted Iron Poles.

For the following information we are indebted to E. M. Lawton, United States consular agent in Oaxaca, Mexico.

The iron street poles of the local electric lighting company's transmission lines have been in service some nine years. They are of the common tubular iron type, about 4.5 inches outside diameter at the base. Recently, it was found that nearly all the poles were badly rusted just below the surface of the pavements and in some cases only held erect by the wires.

The same difficulty having been encountered in the city of Mexico, the Oaxaca lighting company commenced to mold subbases of cement concrete around the poles, as was done in Mexico, the reinforcement extending two feet above the pavement, and about a foot below. But through the study and experimentation of Eduardo Fernandez del Campo, the electrical engineer of the lighting company of Oaxaca, a better plan was evolved which is now being used in reinforcing the poles of the entire lighting system.

Mr. del Campo has perfected a small portable foundry for melting cast iron and with a split mold of wrought iron makes a reinforcement of iron around the pole base, three-fourth-inch thick and 18 inches long, of which 12 inches is above the surface of the pavement. The crucible, made of one-fourth-inch sheet iron about 15 inches in diameter and height and lined with fire clay, has extending iron-pipe handles for carrying and pouring the metal. This is surmounted with a removable sheet-iron cupola of the same diameter and 39 inches high, also lined. Six inches above the bottom of the cupola is the opening for the blast, which is supplied by a small rotary fan driven by a quarter-horsepower, three-phase motor. In charging the cupola, four kilos of coke, mixed liberally with pieces of arc-light carbon, is put into the furnace, with 20 kilos of iron as the top charge. By the time the nine pounds of coke is slowly consumed, the iron is melted sufficiently for pouring, and the whole cost of operation is estimated by the local lighting company, as less than a dollar, United States currency, per pole.



Motor-Driven Rotary Planer.

Motor-Driven Rotary Planer.

The accompanying illustration shows an interesting form of planer for very large work, such as facing the ends of columns, cast-iron bed plates, stringers, etc., and machining engine frames and other heavy castings. The cutting tools are arranged in a circle, which rotates when in operation.

The machine can handle work 40 inches wide and 6 feet long. It is mounted on a circular base on which it can be turned, thus increasing its range of operation. It is manufactured by the Newton Machine Tool Works, Philadelphia, Pa., and is driven by a Westinghouse motor.

A New Method of Cooling Gas Engines.

Ordinarily about 30 per cent of the heat value of the fuel passes from the hot gases to the cylinder walls and pistons, states Prof. Bertram Hopkinson, in a paper recently read before the Institution of Mechanical Engineers, at Cambridge, England, describing a new method of cooling the cylinder and piston of gas engines. In order to prevent the overheating of these parts under ordinary

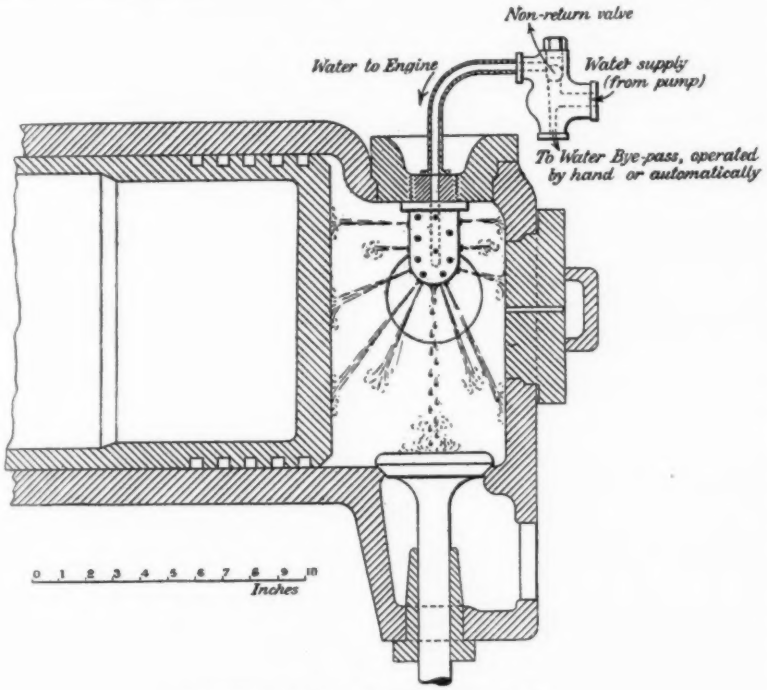
conditions, it is necessary to provide a water jacket around the cylinder, and, in the case of large engines, to circulate water through the pistons and around the exhaust valves.

Most of the disadvantages under which gas engines labor are due directly or indirectly to this fact. The complicated and thick-walled castings required for the cylinders are apt to crack under the influence of the wide variations of temperature, and overheating of deposits on the internal walls of the combustion chamber causes pre-ignition, so that it is not always practicable to work a gas engine continuously at its maximum output.

The idea of introducing water into an internal-combustion engine is not new. It is a common practice in oil engines to introduce water along with the oil in order to permit the compression to be raised, and water has been injected into gas engines for the purpose of preventing pre-ignition. Proposals have also been made to introduce water for the purpose of cooling parts of the metal. None of the latter, however, have been practical, if indeed they have ever been more than just proposals on paper, apparently because their originators did not appreciate the conditions which must be satisfied with the injected water to act as an effective cooling agent.

If the water be turned into steam before reaching the metal it will not exert any cooling effect, except indirectly by lowering the temperature of the flame, and such lowered temperature is accompanied by a considerable loss of efficiency. On the other hand, water which reaches the walls in liquid form and is there evaporated, absorbs out of the heat given to the walls by the gas the whole of its own heat of evaporation, and there is no loss of thermodynamic efficiency, because the heat used is waste heat, which, in a jacketed engine, would go to warm the cooling water.

Professor Hopkinson claims that it is of no use to inject the water in a fine spray, or to introduce it into the gas or air pipe, so that it is carried in suspension in the incoming charge, or, as is often done in oil engines, to spray it in along with the oil. Although some of these devices have proved useful for the prevention of pre-ignition and for the softening of the explosion, none are effective for the purpose of cooling.


Non-return valve
Water to Engine
Water supply (from pump)
To Water Bye-pass, operated by hand or automatically
0 1 2 3 4 5 6 7 8 9 in
Inches

Hopkinson Method of Cooling Gas Engines.

The author found, however, that by injecting water in comparatively coarse jets against the internal surface of the cylinder, and the head of the piston, the metal can be kept cool without materially cooling the gases, with the result that there is no loss of efficiency. The temperature of the parts can be perfectly controlled, and simple single-walled castings can be used for the cylinders.

Experiments of Dugald Clerk, the author, and others have shown that the rate of heat-flow from the gas into the metal is far more rapid at and soon after the instant of ignition than at any other time. It seems likely from these experiments that for practical purposes the heat flow into the barrel of the cylinder during the last three-fourths of the expansion stroke might be so small compared with that in the first period that direct cooling of this portion of the cylinder could be dispensed with altogether. This anticipation has been found correct, and it has been found necessary only to direct the spray against the walls in the combustion chamber, and the piston, the rest of the cylinder being kept cool by conduction. Cold water is injected through a hollow casting projecting into the combustion chamber and provided with a number of nozzles or holes about one-thirty-second inch in diameter.

For the purpose of experiment, an 11.5 by 21-inch Crossley engine, rated at 40 horsepower, was fitted with a new cylinder consisting of a plain barrel without a water jacket. The injection rose or nozzle is a hollow casting projecting into the combustion chamber and provided with 25 holes. The drip from the rose suffices to cool the exhaust valve. A simple plunger pump driven by a cam injects a charge of water once in a cycle, lasting from about 30 degrees before to 30 degrees after the point of the sliding surface of the barrel is covered by the piston. The quantity of water used was about 2.4 pounds per brake horsepower-hour, and the temperature of the engine ranged from 150 to 180 degrees Centigrade. The engine consumed about 15 cubic feet of coal gas per brake horsepower-hour, both when it was water-jacketed and after being fitted with the new cylinder.

Tests at other loads showed that with a weak mixture the gas consumption is slightly increased by the water injection, but with very rich mixtures it is a trifle less. The difference, however, does not exceed five per cent either way, and on the average it may be said that the economy is unaffected by the use of this method of cooling.

This engine was set to work driving a dynamo, and its speed was increased from 180 to 195 revolutions per minute, when it was found capable of developing 50 brake horsepower for many hours, an increase of 25 per cent on its original maximum safe load. It has now been running for a total period of 5,000 hours on regular work, giving no trouble at all, and the combined wear on both cylinder and piston is less than 0.01 inch.

To regulate the water supply in accordance with the load the pump is connected to the governor, which is of the hit-and-miss type, so that the pump only takes a stroke when the engine takes gas.

In case of failure of the water supply nothing happens except that the engine slowly heats up, and after ten minutes or so, pre-ignitions occur, bringing the engine to a standstill. No damage results from this, but to guard against any possible danger a fusible safety plug is screwed into the combustion chamber, which melts if the cylinder gets too hot, and the noise of the escaping gases warns the attendant.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

CLERMONT, FLA.—J. F. Knapp is planning to establish an electric light plant here.

GLENDIVE, MONT.—Einar Rivener is interested in establishing improved electric lighting.

MOCCASIN, MONT.—The Commercial Club has taken up the proposition of street lighting here. C.

MORTON, WASH.—A franchise has been granted to F. M. Broadbent for an electric light and power plant in this city. C.

HAZELTON, PA.—A municipal light plant is being considered. Address the city clerk in regard thereto.

ATHENS, O.—Ohio University is planning a lighting plant which will supply power for experiment purposes also. R.

HAILEY, IDAHO.—The Rockwell-White Power Company will extend its power and light lines in this city immediately. O.

MORTON, WASH.—F. H. Broadbent has been granted a 40-year franchise to operate an electric light and power plant here.

IMPERIAL, CAL. — The City Trustees will expend $40,000 for electric lighting and power. Address the City Clerk for information.

WAUKON, IOWA.—Twenty-five thousand dollars will be expended improving the lighting system. Address A. T. Nierling for particulars.

GREENSPRING, O.—The Greenspring electric light and power plant, owned by D. M. Scott, was almost completely destroyed by fire.

RICHMOND BEACH, WASH.—The Edmonds Light & Power Company has been granted a 40-year franchise to operate in this locality.

SPOKANE, WASH.—The City Council has passed an ordinance providing for the installation of luminous arc lights along Riverside Street.

COMPTON, CAL.—The City Council has granted the Pacific Light & Power Company permission to operate in this city for a period of 50 years.

NATIONAL CITY, CAL.—Bids will be received up to November 18 for lighting the city for a period of five years, beginning December 18, 1913.

LAMOURE, N. D.—LaMoure Light & Power Company has been incorporated with a capital of $24,000, by M. A. Erickson, T. A. Curtis and others.

HENRYVILLE, IND. — Edward Dietrich, is preparing to install an electric light plant, it is reported, the cost of which is estimated to be $10,000. G.

ROBSTOWN, TEX. — Robstown Light Company has been incorporated with a capital stock of $25,000 by R. R. McNeil, H. R. Sutherland and W. E. Pope.

DUNKERTON, IOWA.—A franchise has been granted to J. A. Renz, for the installation of an electric light plant here to supply the city residents.

BOONEVILLE, MISS. — The Booneville Water Company plans the installation of an electric light system and is to purchase a 60-kilowatt generator. G.

LISBON, N. D.—The Lisbon Electric Light & Power Company has been incorporated with a capital stock of $30,000 by H. H. Weeden, of Lisbon and others.

NEW WILMINGTON, O.—The Mahoning & Shenango Valley Railroad & Light Company plans the extension of its lines from Newcastle to this place. R.

RACINE, WIS.—The City Council is planning to place all electric light and telephone wires underground. Address H. Connoly, city engineer, for particulars.

RAYMOND, WASH.—R. L. Fisher, of this city, will install an electric lighting system in Lebam, obtaining power from the Lebam Mill & Timber Company's mill. O.

FAIRLAND, OKLA.—The Fairland Light & Power Company is planning to purchase a 30-kilowatt generator and install storage batteries to maintain 50 house lamps.

ANACONDA, MONT.—The Board of Public Works will require all electric wires to be placed underground. Address Paul A. Gow, City engineer, for particulars.

WATERTOWN, MINN.—A company will be organized here, headed by James J. Ponsford and Guy E. Halgren, to build an electric light system for the village. C.

SEBREE, KY.—The Warren Light & Power Company has been established and will operate a plant in connection with the flour mill of the Warren Milling Company. G.

THOUSAND SPRINGS, IDAHO.—The Thousand Springs Power Company will enlarge its plant to produce 10,000 horsepower, only 3,000 being produced at this time.

CALIFORNIA, MO.—The California Electric Light & Power Company is planning to install a 150-horsepower boiler, 125-horsepower engine and a 100-kilowatt generator.

HARRODSBURG, KY.—It has been decided to issue $12,000 in bonds for the purpose of improving the electric light plant. The clerk of the Council can give information. G.

PROSSER, WASH.—The Pacific Power & Light Company will extend a power line along the Model Orchard Road for several miles. Work of construction will begin at once. O.

ESTERVILLE, IOWA.—The Council is planning ways and means to develop power from the Des Moines River sufficient to run the electric plant. Address the city clerk for particulars.

AUSTELL, GA.—Current for the municipal electric lighting system will be obtained from Factory Shoals, seven miles distant. Address J. B. McCrary Company, of Atlanta, Ga., for information.

LIMA, O.—The Schoepf Syndicate announces the intention of spending $78,000 on improvements here. A power house will be constructed to feed all lines in which the syndicate is interested. R.

LOS ANGELES, CAL.—The Board of Supervisors of Los Angeles County will receive bids until November 17 for the installation and maintanence of a street-lighting system in the Moneta lighting district.

LEAVENWORTH, WASH.—The City Council recently granted a franchise to the Tumwater Light & Water Company to string electric light and telephone wires in this city. The franchise will be of 25 years duration. O.

MADISONVILLE, KY.—The Hopkins County Fiscal Court has granted the right-of-way for the Madisonville & Nortonville Light, Power & Traction Company to build an electric line between this place and Nortonville.

YOUNGSTOWN, O.—The Mahoning County Light Company has been incorporated for service in Youngstown with a capital of $10,000. Harry Engle, P. J. O'Neill, S. S. Conroy, L. A. Manchester, and C. A. Manchester are interested. R.

SPARTA, O.—Morrow County citizens want an electric road to connect Mt. Vernon, Mansfield and Delaware, running through Sparta. It is said that P. B. Chase of this town is willing to subscribe $40,000 and assist in selling stock to promote a line. R.

WATERTOWN, MINN.—A company headed by Guy E. Halgren and James H. Densford has been organized to furnish electric lights and power to Watertown. Plans are being prepared for a power house and construction work will begin as soon as possible.

HUNTSVILLE, ALA.—The Alabama Power Company is making arrangements to establish one of its steam power units in Huntsville and will build a plant here costing $125,000. This plant will supply Huntsville and contiguous territory with electricity in emergencies.

McGREGOR, IOWA.—The McGregor Electric Light & Power Company has been granted a 25-year franchise to erect and maintain lines through town for the transmission of electricity to Monona and intermediate points. Work on the construction of the new line will begin immediately.

KIRKLAND, WASH.—The water-power rights of Patrick Judge on the Tolt River near here have been sold to a New York syndicate, who have organized a power and development Company for the purpose of installing a hydroelectric plant. M. McLean, here, is in charge of the detail work. Plans will be available immediately.

LOS ANGELES, CAL.—The Mt. Whitney Power Company has applied to the Railroad Commission for authority to issue bonds in the sum of $250,000 for the purpose of extending its system. One of the items will be the completion of the fifth power plant on the Kaweah River above Lemon Cove, and new transmission systems are to be built in the Strathmore, Woodville and Porterville districts.

TACOMA, WASH.—Plans for Tacoma's "Great White Way" are about completed by Electrical Superintendent, B. W. Collins, and an ordinance creating an improvement district to install voluminous arc lights along all of Tacoma's down-town business streets, will be introduced within a few weeks. Experimental lights which were installed on Eleventh Street it is stated have given infinite satisfaction to City Officials. O.

BALLINGER, TEX.—Citizens of Ballinger and surrounding territory are considering a proposition to build a large irrigation and power dam on the Colorado River to cost about $4,000,000. The proposed dam would form a reservoir which would irrigate 300,000 acres. An attempt will be made to have the Federal Government take up the matter if the proposition now under consideration falls through.

HUMANSVILLE, MO.—The Humansville Electric Light Company has been granted a franchise covering a period of years. The Humansville Company is but recently organized and beside furnishing this city with electricity will pump the water supply into the mains. Included in the measure is the specification that a plant and facilities to properly light a city of 10,000 population shall be constructed under the approval of the city officials.

MONTGOMERY, ALA.—It has been announced by Edgar B. Kay that a network of long-distance power transmission lines will soon furnish electricity in abundance for numerous towns in south Alabama following the completion of the monster water power plant on the Pea River, five miles south of Elba. Troy and Elba will be the first towns benefited and soon thereafter lines will be stretched to Enterprise, Andalusia, Opp and other places in that section.

FILLMORE, CAL.—J. A. Heaston and Constant W. Booth of Huntington Park, both civil and mining engineers, are making surveys and plans for a big power plant that it is their intention to install. A company, known as the Sespe Light & Power Company was recently incorporated and one of its first acts was to file an appropriation notice on 10,000 inches of water to be diverted from the stream. According to the plans as described by Messrs. Heaston and Booth, it is proposed to construct several dams across the stream and impound the flood waters which now run to waste in the winter. By this method ample power to supply the needs of Ventura County at all times would be available.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

WICHITA, KANS.—The Pioneer Telephone and Telegraph Company is contemplating extending its line through Osage County.

STANLEY, N. D.—Fairview Farmers' Telephone Company has been incorporated with a capital of $25,000 by C. N. Platt and others. C.

HAINES CITY, FLA.—F. D. Shepard will construct a telephone system to extend from Haines City to Davenport and Lake Walkes.

NEWTON, IOWA.—Newton Telephone Company has been incorporated with a capital of $3,500. Ole Thoreno is president and Oscar Solmonson, secretary. C.

PEORIA, ILL.—The Central Union Telephone Company will improve the long-distance telephone service between Springfield and Peoria. A new line will be built.

ALPIN, N. D.—J. F. Shattuck is one of the incorporators of the Knife River Telephone Company, incorporated to operate a line in Oliver and Mercer Counties.

STANLEY, N. D.—The Fairview Farmers Telephone Company has been incorporated with a capital stock of $2,500 by O. G. Krueger, C. J. Platt and others.

TIGERTON, WIS.—The Comet Telephone Company, Incorporated, has been incorporated with a capital stock of $1,000 by Edward Bauer, Joseph R. Riendl and Charles F. Newmann.

GRAND FORKS, B. C.—The Canadian Government has given instructions for an extension of the Government telephone line, now being constructed from Grand Forks to Lynch Creek, to Franklin Camp. O.

EQUALITY, ILL.—Equality Independent Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are Isaac White, John M. Berry, Jesse M. McLain, Joe G. Bunker and W. A. Aydelott.

SPOKANE, WASH.—The Pacific Telephone & Telegraph Company will build a telephone line to Park Water Addition, also will extend its Wallace Exchange to the Sunset Mines District. The work will cost approximately $5,000. O.

DOS PALOS, CAL.—The Railroad Commission has granted authority to the Dos Palos Telephone Company to issue 1,272 shares of stock. Of this amount 775 shares will be sold at $1.00 per share to provide additions to the company's system.

CENTRALIA, WASH.—The Boistfort Telephone Company recently applied to the Lewis County Commissioners for a franchise to operate and maintain telephone lines in Lewis county, and the farmers of the Salzer Valley are preparing to incorporate for the purpose of constructing these telephone lines. O.

PORTLAND, ORE.—Petitions calling for the amendment of the city charter to provide for a municipal telephone system, to be owned or leased by the city, will be circulated at once, according to the announcement by A. B. Cridge, a prominent business man here, and one of the prime movers in the project. The matter will be placed before the people. O.

ELECTRIC RAILWAYS.

(Special Correspondence.)

JACKSON, TENN.—The Jackson Railway & Light Company has been granted a 50-year franchise for the extension of its line into West Jackson.

NEW ORLEANS, LA.—The Kenner-New Orleans Interurban Railway Company has notified L. C. Weiss, this city, to prepare plans for a power house.

PORTLAND, ORE.—H. P. Scheel, of Tenino, Wash., heads an organization which will build an electric line 30 miles in length, at a cost of $500,000.

QUINCY, ILL.—The Tri State interurban will be constructed between Quincy and Burlington, Iowa, at a cost of $3,000,000. This amount has been raised by Richard Marsh, of Warsaw.

CHARLES CITY, IOWA.—The Commercial Club has taken up a proposition to build an extension to the city railway, electrify its present line, and give electric service along the interurban line.

SPARTANBURG, S. C.—An interurban railway will be built from Spartanburg to Cross Anchor, S. C. Address A. B. Leach & Company, 149 Broadway, New York, for further information.

PLEASANTON, TEX.—A project is on foot to construct an electric interurban line between this place and Jourdanton, a distance of about eight miles, in order to give better connection with San Antonio. D.

JEFFERSON, O.—The Chardon, Jefferson & Meadville Electric Railway has applied to Chardon and Ashtabula Councils and Geauga County Commissioners for right of way and assistance in its projected line. R.

GREENFIELD, MICH.—The Council has granted a 30-year franchise to Robert Oklahoma and Leroy M. Gilbert to build a car line connecting the Hamilton Boulevard extension with the Grand River line.

PINE BLUFF, ARK.—Pine Bluff & Sulphur Springs Interurban Railway Company is making surveys for a railway from Pine Bluff to Sulphur Springs. Address A. G. Russel, president, for information.

BRYAN, TEX.—It is stated by O. E. Gammil, general manager of the Bryan-College interurban line, that arrangements have been completed for the electrification of the road, which runs between Bryan and College Station.

ROCK ISLAND, ILL.—Tri-City Railway Company has been incorporated with a capital stock of $2,500 to maintain and operate street railways, electric and other motive power. J. F. Porter, H. E. Weeks and J. G. Huntoon are the incorporators.

CONNEAUT, O.—John H. Ruhlman, president of the Lake Erie & Youngstown Railway, announces the new line will be built south from Youngstown to Steubenville, making a new direct route from the Ohio River to the lake. Ten miles of roadbed have already been completed. R.

FAIRMONT, W. VA.—The Petersburg & Columbia Springs Railway Company has been organized with a capital stock of $5,000 to build a line of railroad from Petersburg to Columbia Sulphur Springs. The incorporators are Marcus H. Hite, John N. Hite and others.

CALDWELL, IDAHO.—It is reported that the Oregon Short Line Railway Company has purchased the holdings of the Caldwell Traction Company, which includes 20 miles of electric railways, and will immediately make improvements. James Magee is general manager of the Caldwell Traction Company. O.

PORTLAND, ORE.—Without opposition, the City Commission recently passed to a third reading a franchise asked for by George F. Heusner, for an interurban electric line from the Kenton district to the West Side Business District,—also a franchise for a cross-town car line, on the east side, which will be a part of the Portland Railway Light & Power Company system. O.

LOUISVILLE, KY.—The Louisville & Nashville Railroad Company has decided on an expenditure of $500,000 during 1914, it is reported, in the establishment of improved signaling equipment. Electric block signals, with the latest interlocking devices, are to be put into use, the main line in Central Kentucky having been decided on as the place to begin. Wible Mapother, first vice-president of the company, may be able to give details concerning the work. G.

PROPOSALS.

ELECTRIC WIRING AND TELEPHONE CONDUITS.—Bids will be received November 25 for conduits, electric light and power wiring and telephone conduits of the Grand Forks County courthouse, at Grand Forks, N. D., according to plans and specifications made by Beuchner and Orth, architects. Address Hans Anderson, county auditor.

TRANSFORMERS, ETC.—Sealed proposals will be received by the General Purchasing Agent, Isthmian Canal Commission, Washington, D. C., until November 24 for furnishing transformers, steel cable, etc., as per Canal Circular 807. Blanks and general information may be obtained from the Purchasing Agents located in any of the large cities of the United States.

TRANSMISSION LINE.—Sealed proposals will be received by the North Missouri Light & Power Company, New London, Mo., until November 21 for furnishing material and the construction of approximately 35 miles of 33,000-volt three-phase transmission line. Plans and specifications may be obtained from Mr. J. D. Smith, New London, or the Fuller-Coult Company, Chemical Building, St. Louis, Mo.

ELECTRIC FLOOR SANDING MACHINE.—Sealed proposals will be received by the Purchasing Agent, Isthmian Canal Commission, Washington, D. C., until November 12 for furnishing under Z. R. 7013-A one four or five-horsepower electric floor-sanding machine, with side roller attachment, to permit working up to baseboard. Motor to be 230 volts, three-phase, 25 cycles. Further information may be had upon application to F. C. Boggs, major, corps of engineers, U. S. Army, general purchasing officer.

SWITCHBOARD.—Sealed proposals will be received under Proposal 681 at the office of the Chief Signal Officer, War Department, Washington, D. C., until November 29 for furnishing one switchboard, common battery, lamp line, three position (total capacity, 600 common battery lines, 40 magneto lines, and 45 cord circuits), completely wired, but only equipped for 400 C. B. lines, 38 magneto lines, and 30 cord circuits. Detailed information may be had upon application to W. L. Clark, major, signal corps, U. S. Army, disbursing officer.

ELECTRIC CONDUITS AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until December 16 for furnishing the electric conduit and wiring in the post office at Marlin, Tex., and for the same in the post office at Winston-Salem, N. C.; and until December 18 for the same for the post office at La Junta, Colo. Drawings and specifications may be obtained from the office of the Supervising Architect or the custodians of the sites named.

CABLE AND CABLE HANGERS.—Sealed proposals will be received at the Engineer Depot, U. S. Army, Washington Barracks, D. C., until November 14 for furnishing 1,500 feet, 460 mils., solid equivalent (No. 4/0 B. & S. G.) stranded single-conductor rubber-insulated armored cable, and 4,340 feet 9-conductor stranded-rubber insulated armored cable; until November 17 for furnishing 500 galvanized-iron cable hangers (sheet 16), with screws and expansion bolts; and 2,640 feet, 460 mils., solid equivalent (No. 4/0 B. & S. G.) single-conductor lead-covered armored cable stranded. Conductors of all cables shall be of soft-drawn copper wire, having a conductivity of at least 98 per cent Matthiessen's standard in a stranded cable. No joints in the wires shall occur within 12 inches of a joint in any other wire. The cable to be placed on reels as follows: Four reels of 500 feet and one reel of 640 feet. Further information may be had upon application to Joseph E. Kuhn, lieutenant colonel, corps of engineers, U. S. Army.

ELECTRICAL EQUIPMENT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until November 18 for furnishing 30 detectors for radio receiving sets; one five-kilowatt radio transformer, as per Schedule 5,975, and 81,000 feet of telegraph wire of 102-inch diameter, as per Schedule 5,981, to be delivered at the Navy Yard, Brooklyn, N. Y.; and 143 telephones and spare parts, as per Schedule 5,976, to be delivered at the Navy Yard, Philadelphia, Pa.; until November 25 for furnishing one electrically heated combination sterilizer complete, as per Schedule 5,986 and 130,000 feet of silicon bronze aerial wire, as per Schedule 6,006, to be delivered at the Navy Yard, Brooklyn, N. Y.; two each transmitters and indicators, for engine room mechanical telegraph, as per Schedule 5,979, to be delivered at the Navy Yard, Mare Island, Cal., and one direct-current exciter unit, oil-engine driven, as per Schedule 5,990, to be delivered at the Navy Yard, Annapolis, Md.; until December 2 for furnishing one electrically operated potato peeler, as per Schedule 6,008, for delivery at the Navy Yard, Norfolk, Va.; and several motor-driven tools, as per Schedule 5,992, to be delivered at the Navy Yard, Mare Island, Cal.

FINANCIAL NOTES.

The directors of the Edison Company of Boston have voted that the proposed issue of 22,753 shares of new stock, if authorized by the Gas Commission, be offered to stockholders for subscription at $215 a share, in the ratio of one new share for eight shares now held.

Stockholders of the Puget Sound Traction, Light & Power Company (Stone & Webster property) of record November 1, have right to subscribe to $2,626,200 preferred stock. Stockholders, at a special meeting, authorized issue of this stock. Stockholders may subscribe at $100 per share for one-eleventh of a share of new preferred for each $100 of preferred or common held. Subscriptions will be payable on or before December 8, 1913.

Advices from Toronto state that the directors of the Mexico Tramways Company have authorized an issue of $1,200,000 three-year six-per-cent notes convertible into common stock of the company at par during the currency of the notes. A special meeting of the stockholders has been called to be held in Toronto on November 20 to vote upon an issue of $10,000,000 common stock to cover the convertible feature of the notes. The conversion rights of the notes call for the provision of $6,000,000 stock, but should it not be used for conversion purposes it, together with the remaining $4,000,000, will be held in the treasury for the future purposes of the company.

The properties and franchises of the gas and electric light corporation and the street railway company of Phoenixville, Pa., have been acquired by the American Gas Company, which intends to merge these concerns with the Philadelphia Suburban Gas & Electric Company. The Phoenixville franchises held by the Phoenix Gas & Electric Company, of Phoenixville, had been controlled by Phoenixville capital for many years, and the hundreds of bondholders in the concern have lost heavily in the transfer. The company was capitalized at $1,000,000 and most of its bonds were held by Phoenixville investors. They sold out at fifty cents on the dollar. The new company intends to acquire additional trolley franchises in the county.

General Electric Company's total sales billed for the year ending next month will come pretty close to touching the $100,000,000 mark. Last year the figures were $89,182,000 and officials of the company expect this year's gain to run between 10 per cent and 12 per cent. This would compare with previous years as follows:

Year to Dec. 31:	Sales Billed.	Increase.
1912	$89,182,185	$18,798,331
1911	70,383,854	*1,094,704
1910	71,478,558	19,821,927
1909 (11 mos.)	51,656,631	7,115,955
Year to January 31:		
1909	44,540,676	*26,436,492
1908	70,977,168	10,905,285
1907	60,071,883	16,924,891

*Decrease.

Plants of the company are running virtually at capacity. An official denies that there has been any decrease of consequence in the number of employees. The volume of unfilled orders at the end of 1912 was so large and the incoming orders this year so heavy that it has been impossible, he says, to make any decided reduction in employees. A slowing down in business is anticipated in this as well as other lines. It has already been indicated for the General Electric Company by a small recession in receipts of incoming orders. Viewing the outlook at this stage of the fiscal year, it would

not be surprising to the company if the volume of unfilled orders on December 31 should equal, if not exceed, the figures of last year. There is several months of work now on land.

The protective committee of the United Light & Power Company, a subsidiary of the United Properties Company, has approved the plan of R. G. Hanford and William H. Tevis for financing the property. The plan, with the committee's approval, has been submitted to the trustees of F. M. Smith and the United Properties Company. The plan provides that the $1,800,000, approximately the amount which the United Light & Power Company owes Tevis and Hanford, be exchanged for United Light & Power Company stock at 75. Note holders of the United Light & Power Company are to be protected by an agreement which Mr. Hanford has with the English syndicate, by which the outstanding notes will be paid as they mature, through an agreement which provides for the underwriting of long-term bonds, now held as collateral for the notes, when released. The agreement also provides for the underwriting of $345,000 long-term bonds now in the company's treasury.

Dividends.

Central Arkansas Railway & Light Company; quarterly of 1.75 per cent on the preferred stock, payable December 1 to stock of record November 15.

Federal Light & Traction Company; quarterly of 1.5 per cent on the preferred stock, payable December 1 to stock of record November 15.

Kings County Electric Light & Power Company; regular quarterly of two per cent, payable December 1 to stock of record November 20.

Mobile Electric Company; quarterly of 1.75 per cent on preferred, payable November 15 to stock of record October 31.

Ontario Power Company; quarterly of 1.25 per cent, payable December 1 to stock of record November 22.

Pennsylvania Lighting Company; one per cent on the common, payable November 30 to stock of record November 15.

Rochester Railway & Light Company; quarterly of 1.25 per cent on preferred, payable December 1 to stock of record November 24.

Reports of Earnings.

PHILADELPHIA COMPANY.

Earnings of the Philadelphia Company for the first six months of the fiscal year, to Sept. 30, 1913, are as follows:

Gross from operation	$11,861,252
Net from operation	4,313,755
Surplus	1,502,729

DETROIT UNITED.

	1913	1912
September gross	$1,067,358	$1,059,318
September net	338,034	337,706
Other income	19,909	16,779
Total income	357,943	354,485
Surplus after charges	176,621	178,729
Nine months' gross	9,739,642	8,661,209
Nine months' net	3,193,623	2,977,961
Other income	182,153	151,759
Total income	3,375,776	3,129,720
Surplus after charges	1,757,062	1,535,139

NORTHERN STATES POWER.

The Consumers Power Company of Minnesota, the operating corporation of the Northern States Power Company, reports earnings for the year ended September 30, 1913, as follows:

	1913	1912
Gross earnings	$3,820,351	$3,445,086
Operation and taxes	1,877,920	1,723,978
Net earnings	1,942,431	1,721,108
Interest on bonds	1,197,965	.....
Interest on notes	24,000	.....
Balance	720,466	.....

MASSACHUSETTS ELECTRIC.

The Massachusetts Electric Company reports for the quarter ended September 30, 1913, as follows:

	1913	1912
Gross	$2,933,945	$2,821,607
Net	1,186,138	1,291,816
Surplus after charges.	668,207	796,054

NORTHERN OHIO TRACTION & LIGHT.

	1913	1912
September gross	$ 289,022	$ 268,073
Net after taxes	119,802	121,671
Surplus after charges.	59,489	70,074
Nine months gross	2,444,698	2,247,866
Net after taxes	973,662	990,294
Surplus after charges.	449,584	574,954

MONTREAL LIGHT & POWER.

	1913	1912
August net	$ 248,117	$ 227,328
Four months gross	968,624	883,002

CUMBERLAND COUNTY POWER & LIGHT.

	1913	1912
September gross	$ 218,398	$ 190,630
Net after taxes	91,932	89,758
Surplus after charges..	28,273	32,798
Twelve months' gross..	2,278,877	2,097,982
Net after taxes	1,010,139	879,099
Surplus after charges.	317,223	251,243
*Balance after preferred dividends	195,223	191,243

*Equivalent to 7.2 per cent on the common stock.

NORTHERN CALIFORNIA POWER COMPANY.

The report of the Northern California Power Company, Consolidated, for the month of September is as follows:

	Sept. 1913	Sept. 1912
Gross earnings	$ 77,241	$ 67,810
Operating expenses, including taxes	24,696	28,560
Net revenue	$ 52,545	$ 39,250
Interest	29,477	29,498
Operating surplus	$ 23,063	$ 9,751

TWIN CITY LINES.

	1913	1912
September gross	$ 787,890	$ 730,844
Net	400,540	379,157
Surplus after charges.	256,428	236,078
Nine months gross	6,568,762	6,089,072
Net	3,232,544	2,979,162
Surplus after charges.	1,909,698	1,694,450

PUGET SOUND TRACTION, LIGHT & POWER.

The Puget Sound Traction, Light & Power Company report earnings as follows for August, and 12 months ended August 31:

	1913	1912
August gross	$ 723,529	$ 680,206
Net after taxes	313,507	277,537
Twelve months gross..	8,444,058	112,728
Net after taxes	3,533,575	.....
Surplus after charges.	1,488,560	.....

LAKE SHORE ELECTRIC.

	1913	1912
September gross	$ 133,404	$ 125,742
Net after taxes	63,871	59,364
Surplus after charges.	28,658	24,196
Nine months gross	1,075,871	995,820
Net after taxes	447,575	431,927
Surplus after charges.	131,369	117,510

ST. JOSEPH RAILWAY, LIGHT & POWER.

	1913	1912
September gross	$ 106,445	$ 95,875
Net after taxes	43,142	39,004
Surplus after charges..	22,944	19,294
Twelve months' gross..	1,236,783	1,151,645
Net after taxes	538,219	480,021
Surplus after charges.	298,046	244,880
Balance after preferred dividends	*220,046	166,880

*Equivalent to 6.3 per cent on the common stock.

BRAZILIAN TRACTION, LIGHT & POWER.

	1913	1912
September gross	$ 1,965,326	$ 1,691,298
Net after taxes	1,099,926	953,901
Nine months' gross..	17,589,764	15,184,667
Net after taxes	9,467,755	8,182,546

OMAHA & COUNCIL BLUFFS STREET RAILWAY.

	1913	1912
September gross	$ 251,451	$ 239,084
Net after taxes	125,245	120,240
Surplus after charges	55,954	50,579
Nine months gross	2,224,920	2,098,472
Net after taxes	1,069,258	985,814
Surplus after charges	446,949	371,581

NEW ORLEANS RAILWAY & LIGHT.

The report of the New Orleans Railway & Light Company for the nine months ended Sept. 30, 1913, compares as follows:

	1913	1912
Gross	$5,082,654	$4,878,980
Net after taxes	1,855,689	1,898,705
Surplus after charges.	564,962	650,916

AMERICAN LIGHT & TRACTION.

American Light & Traction Company report for the 12 months ended Sept. 30, 1913, compares as follows:

	1913	1912
Gross	$4,396,865	$4,190,997
Net	4,274,939	4,072,260
Preferred dividends	854,172	854,172
Common dividend	1,308,662	1,186,132
Common stock dividends	1,308,662	1,186,132
Total dividends	3,471,497	3,226,437
Surplus	803,442	845,823
Previous surplus	8,277,994	7,432,171
P. & L. surplus	9,081,436	8,277,994

AMERICAN GAS & ELECTRIC.

Subsidiaries of the American Gas & Electric Company report earnings for the year ended September 30, 1913, compared as follows:

CANTON ELECTRIC.

	1913	1912
Gross earnings	$388,327	$340,939
Net after taxes	196,403	169,241
Surplus after charges..	136,655	112,284

MARION LIGHT & HEATING.

	1913	1912
Gross earnings	$246,585	$218,518
Net after taxes	114,318	86,992
Surplus after charges..	69,557	49,387

BRAZIL RAILWAY.

	1913	1912
August gross	£ 239,400	£ 201,727
Net	80,133	77,678
Eight months gross	1,815,534	1,700,505
Net	648,400	745,211

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Nov. 10	Nov. 3
American Tel. & Tel. (New York)	119½	120⅞
Commonwealth Edison (Chicago)	139	139⅛
Edison Electric Illuminating (Boston)	264½	264½
Electric Storage Battery common (Philadelphia)	45½	46
Electric Storage Battery preferred (Philadelphia)	45½	46
General Electric (New York)	139¼	140¼
Kings County Electric (New York)	119	119
Manhattan Transit (New York)	1	1¼
Massachusetts Electric common (Boston)	11	11½
Massachusetts Electric preferred (Boston)	67	67¼
National Carbon common (Chicago)	133	133
National Carbon preferred (Chicago)	114	114¾
New England Telephone (Boston)	139	139¾
Philadelphia Electric (Philadelphia)	22⅜	22½
Postal Telegraph and Cables common (New York)	77	78
Postal Telegraph and Cables preferred (New York)	63	63
Western Union (New York)	61	63
Westinghouse common (New York)	65	66½
Westinghouse preferred (New York)	110	110

*Last price quoted.

PERSONAL MENTION.

MR. J. P. PROVOST, vice-president of the Union Electric Company, Pittsburgh, Pa., was married on October 22 to Miss Alice Bigler, of Clearfield, Pa. Upon their return from their wedding trip they will reside in Pittsburgh.

MR. W. D. KYLE, general manager of the Line Material Company, of South Milwaukee, Wis., is receiving the congratulations and well wishes of his many friends upon his wedding, November 1, to Miss Margaret Adams of Milwaukee.

MR. NICHOLAS F. BRADY has been elected president to succeed the late MR. ANTHONY N. BRADY, of the Kings County Electric Light & Power Company, Brooklyn. MR. J. C. BRADY has been elected a director to succeed his father, and vice-president to succeed MR. N. F. BRADY.

Mr. C. N. DUFFY has resigned as vice-president and controller of the Milwaukee Electric Railway & Light Company, to accept the position of vice-president and general manager of the Manila Electric Railway & Light Company. Mr. Duffy entered the employ of the Milwaukee Electric Railway & Light Company as controller on October 1, 1906. Previous to this he had occupied similar positions in Chicago, New York and St. Louis. He was one of the charter members and one of the first presidents of the American Electric Railway Accountants' Association, and was for years the chairman of the committee on classification of accounts. He prepared the classification of accounts recognized and used as standard by electric railways until superseded by the official classifications promulgated by the Interstate Commerce Commission and the various state railroad commissions. The classification of these latter, however, are based very largely on the work which Mr. Duffy had completed. He has taken a very prominent part in the affairs of the American Electric Railway Association, having been a member of the committee on rates and fares, chairman of the committee on company sections, and has been a practical contributor to the literature of the subject and has appeared prominently as a contributor to the papers and discussions of the conventions of the Association. He is a gold-medal man for the best paper presented before a company section in both the National Electric Light Association and the American Electric Railway Association. His studies in the cost of street railway service and the effect of varying factors have made him a recognized authority on the economics of electric railway finances. He was chosen by the Cleveland Electric Railway to represent it in its arbitration last spring with the city of Cleveland. His analysis of the so-called three-cent fare in Cleveland, presented as an address before the recent convention of the American Electric Railway Association, attracted a great deal of attention, and, in fact, was one of the most important communications to the proceedings of this convention. Mr. Duffy is a member of the Milwaukee Club, Milwaukee Athletic Club, Deutscher Club, Press Club, Traffic Club, Advertisers Club, a director of the Citizens Business League, a regent of Marquette University, and one of the leading spirits in the Milwaukee Citizens Bureau of Efficiency. He has won the esteem of his colleagues and employers in Milwaukee, and severs his connection with their organization to their great regret, although they have showered upon him their congratulations and best wishes for his future success.

OBITUARY.

PROFESSOR WILHELM HOLTZ, inventor of the Holtz influence machine died on September 30 at Greifswald, Germany, at the age of 77 years.

MR. JAMES PASS, president of Pass & Seymour, Incorporated, died at his residence at Syracuse, N. Y., on October 30, after an illness of 10 days. Mr. Pass was one of the most prominent business men of Syracuse, and besides his connection with Pass & Seymour, Incorporated, was president and general manager of the Onondaga Pottery Company and a director of the First National Bank. He was connected with numerous clubs, was a charter member of the American Ceramic Society, and in 1896 and 1897 was honored with the presidency of the United States Potters' Association. Mr. Pass was born in Burslem, Staffordshire England, June 1, 1856. His father, Richard

James Pass.

Pass, was a pottery manufacturer and the birthplace of the son was in the heart of the pottery district of his native country. In 1863 his father brought the family to America, for a time residing in Cincinnati, O. At the close of the Civil War he removed to Trenton, N. J., and in 1875 went to Syracuse as superintendent of the Onondaga Pottery Company. Mr. James Pass acquired his education largely in the common schools of Trenton, N. J. When he was 13 years old he was apprenticed to a pottery maker at Trenton, serving there under the superintendency of his father, when he went to Syracuse at the age of 18. He became foreman at that time of the Onondaga Pottery Company under his father, remaining in that position until 1881, for several years thereafter spending his time in the west. Mr. Pass returned to Syracuse in 1884 to become general superintendent of the Onondaga Pottery Company, and in 1891 he became general manager, shortly thereafter being chosen vice-president. Under his direction the business of the Onondaga Pottery Company has increased, until it now employes 700 persons. At the time of his first association with the company it employed about 50. In 1877-78 Mr. Pass took a special course in chemistry at Syracuse University to aid him in the manufacture of china. In 1890, associated with Mr. Seymour, he began the manufacture of porcelain for electric insulation. During the first few years the business was confined to the making of porcelain for large electric companies. Later a line of electrical supplies of their own devising was placed on the market. In 1890 Mr. Pass was married to Miss Adelaide M. Salisbury, of Syracuse, who survives him with three children, Miss Elinor S., Richard H., and James S. Pass.

SIR WILLIAM HENRY PREECE, former engineer-in-chief and electrician of the British Post Office, died at London, England, on November 6. Sir William was one of the greatest authorities on telegraphy and telephony. He was born in Wales, February 15, 1834, and educated at Kings College, London. For half a century he was engaged in the practical work of telegraphy, and in recent years, telephony also. Twenty-seven years were spent in the British Post Office, the preceding 16 years having been spent as an employee of the Electric Telegraph Company, which operated prior to 1870, in which year the Crown took over the telegraph control of the country. He took out many patents on telegraph and telephone systems, and introduced into Great Britain much of the present electrical systems of communication. He was also an early experimenter in wireless telegraphy and worked out an electro-magnetic system which was for a long time in practical operation between Lavernock, near Cardiff, and Flatholm, an island in the British Channel, a distance of 3.5 miles. He was for some years president of the Institution of Civil Engineers of Great Britain, and was joint author with Sir James Sivewright of a textbook on telegraphy, with Dr. Maier on a textbook, "The Telephone," with Mr. Stubbs of a "Manual of Telephony." Sir William visited the United States several times in conducting his researchers and developments.

DATES AHEAD.

National Academy of Science. Autumn meeting, Johns Hopkins University, Baltimore, Md., November 18-19.

National Electrical Supply Jobbers' Association. Hot Springs, Va., November 18-20.

National Conservation Congress. Fifth annual convention, Washington, D. C., November 18-20.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual meeting, Columbus, O., November 20-22.

Meeting of Electric Sign Manufacturers to organize an association. La Salle Hotel, Chicago, Ill., December 1.

American Society of Refrigeration Engineers. Annual meeting, New York, N. Y., December 1-2.

American Automobile Association. Richmond, Va., December 1-3.

American Society of Mechanical Engineers. Annual meeting, New York, N. Y., December 2-5.

National Gas Engine Association, Toledo, O., December 4-6.

American Institute of Chemical Engineers, New York, N. Y., December 10-13.

American Association for the Advancement of Science. Annual meeting, Atlanta, Ga., December 29-January 3, 1914.

Western Association of Electrical Inspectors. Annual meeting, Cincinnati, O., January 27, 1914.

NEW INCORPORATIONS.

WACO, TEX.—City Electric Company has been incorporated with a capital stock of $10,000 by William Hodges, C. J. Hodges and J. E. Kuykendall.

BIRD ISLAND, MINN.—Renville County Electric Company has been incorporated by H. B. Rutledge, Glencoe; A. J. Richardson, Bird Island, and others.

BOSTON, MASS.—Federal Hardware & Electric Company has been incorporated by John F. Chevalier and Stephen S. Grady, the capital stock being $10,000. W.

IRON RIVER, WIS.—Iron River Water, Light & Telephone Company, has been incorporated with a capital of $25,000 by T. F. Mackmiller, Alvana Mackmiller, Lillian H. Callahan.

LOS ANGELES, CAL.—Articles of incorporation have been filed here for the Wright-Howard Electric Company with a capital stock of $10,000 by G. C. Wright, W. F. Howard and W. Smith.

SAN FRANCISCO, CAL.—The Retallulen Electric Company has been incorporated here with a capital stock of $50,000 by R. J. McGahie, A. T. O'Connell, A. J. Fritz, J. F. Linares and J. H. Vinter.

CLEVELAND, O.—The DeForrest Electric Welding Company has been incorporated with a capital stock of $5,000 by R. J. Lamb, M. M. McLaughlin, C. F. Niser, H. B. Altman and Edward Cherney.

NEW PHILADELPHIA, O.—The Ohio House Lighting Company has been incorporated, capitalized at $50,000. A. W. Reiser, C. H. Slinghuff, M. Selbold, W. B. Gregson and William Schweitzer are the incorporators.

CLEVELAND, O.—The Kemoo Electric Manufacturing Company has been incorporated with a capitalization of $100,000. The incorporators are Wallace I. Knight, C. G. Roads, Herbert Matthews, D. F. Howe and Lyman D. Rothwell, Jr.

NEWARK, N. J.—The Essex Motors Manufacturing Company has been incorporated with a capital of $100,000 to manufacture motors, electrical supplies, etc. Morton E. Hudden, William H. A. Simpson and John J. Coyle are the incorporators.

NEW YORK, N. Y.—Electric Contractors Company, Incorporated, has been granted articles of incorporation, capitalized at $150,000. The incorporators are Charles Metzger, Brooklyn, N. Y.; Rudolph E. Habel and Arthur S. Henry, of New York City.

WEBSTER CITY, IOWA.—E. H. Martin, president of the Martin Telephone Company, has incorporated the International Telephone Meter Company, capitalized at $1,000,000, for the manufacture and marketing of a telephone meter recently invented by himself. C.

BUFFALO, N. Y.—Buffalo Electric Show, Incorporated, has been granted articles of incorporation for the purpose of conducting electric shows. The capital stock of the concern is given as $500 and the incorporators are George H. Calkins, Frank A. Coupal and William R. Huntley, all of Buffalo.

PITTSBURGH, PA.—Application will be made for a charter for the incorporation of the Westinghouse Gear & Dynamometer Company by Alexander Black, Miles H. England and John G. Buchanan. The company will sell and manufacture gears and dynamometers and devices for the production, transmission and recording of power. S.

BUFFALO, N. Y.—The Auto Electric Equipment Company, Incorporated, has been incorporated. The company is capitalized at $15,000 and is to engage in the manufacture and sale of electric generating machinery, electric devices and appliances. Its directors are Edward W. Werick, Charles H. Werick and Fred C. Schoenthal.

HARRISBURG, PA.—Papers for the merger of two of the Harrisburg electric companies, the Harrisburg Light & Power and the Harrisburg Electric Service, have been filed. The capital is given as $2,500,000 and directors are George Bullock, New York, president; George B. Tripp, Harrisburg, vice-president and general manager; S. J. Dill and F. T. Homer, New York; R. E. Griscom, Havergord; J. S. Banks, Jr., Philadelphia; E. Z. Wallower, H. C. Ross, E. B. Mitchell, E. S. Herman and Warwick M. Ogelsby, Harrisburg.

NEW PUBLICATIONS.

PYROMETER TESTING.—The Bureau of Standards has issued a new (fifth) edition of circular No. 7 dealing with pyrometer testing and heat measurements. This includes a statement of methods and fees for testing thermoelectric pyrometers and electrical-resistance thermometers.

FOREIGN TRADE OPPORTUNITIES.

(Where addresses are omitted they may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C. In applying for addresses refer to file number.)

NO. 11,950.—WIRE-INSULATING MACHINERY.—An American consul has received an inquiry for the names of manufacturers in the United States of machinery for insulating electric wire. Replies should be accompanied by description and prices, all in the Spanish language.

NO. 11,962.—ELECTRIC DYNAMOS AND MACHINE TOOLS.—An engineering house doing a large business in French and English electrical machinery informs an American consulate that it wishes general agencies for American electrical machinery. Correspondence and catalogues must be in Spanish or French.

NO. 11,976.—DRY CELLS.—A report from an American consular officer states that a European business man, who is one of the principal importers of dry cells in the country in which he is located, desires to correspond with American manufacturers of such articles with a view to making direct importations.

NO. 11,977.—VACUUM CLEANERS.—An American consul reports that a resident of his district is desirous of securing quotations on vacuum cleaners suitable for a large hotel.

With the Electrical Manufacturers

The Bentz Richardson Company, Limited, Winnipeg, Man., has been organized at 114 Phoenix Block to introduce and promote the sale of electrical specialties throughout western Canada. The company will represent leading manufacturers, acting as sales agents for panelboards, switchboards, oil switches, cable bells, transformer cutouts, subway boxes and cedar poles.

Mesta Machine Company, Pittsburgh, Pa., has issued bulletin No. 1, dealing with the company's gas engines. These are built in all sizes from 350 horsepower upward and for any kind of fuel gas, such as producer gas, blast-furnace gas, coke-oven gas, or natural gas. The bulletin points out the valuable characteristics of Mesta gas engines and is illustrated with views of a number of typical engine installations.

American District Steam Company, North Tonawanda, N. Y., has issued Bulletin No. 131, containing a paper by Hal C. Kimbrough, entitled "Central-Station Heating in the Smaller Cities." This was read before the convention of the Kansas Gas, Water, Electric Light and Street Railway Association held at Hutchinson, Kans., October 9 to 11. This paper was abstracted in our issue of October 18.

The Calculagraph Company, 1469 Jewelers Building, New York City, has published a very interesting bulletin describing and illustrating how one Calculagraph is capable of recording time on all jobs for any number of workmen. One set of such records as is established by the use of the Calculagraph can be used for both pay roll and figuring the cost of production. The company will send its booklet free to those interested upon request.

W. N. Matthews & Brother, 3740 Forest Park Boulevard, St. Louis, Mo., have sent out folders dealing with the Matthews guy anchor. One of these shows numerous illustrations of these devices installed as storm anchors; halftone illustrations are also shown of several lines with which storms have played havoc and the suggestion is thrown out that immediate attention to guying of exposed lines will eliminate the difficulties depicted by the latter pictures.

The United States Light & Heating Company, Niagara Falls, N. Y., has issued Bulletin 111 describing U-S-L Type K storage batteries for ignition and electric lighting of gasoline automobiles. This bulletin describes and illustrates these batteries and gives complete data and information regarding them. It also contains much general information on storage-battery ratings and has tables and formulas to make it easily possible for any one to determine exactly the right size of battery for any particular service.

The Bristol Company, Waterbury, Conn., has issued catalog No. 1400. This is a 64-page publication devoted to the William H. Bristol electric pyrometers for temperatures up to 2,000 degrees. Among the particular features in this catalog is a new improvement on indicating instruments of this type, a recently improved patented frictionless recording instrument, also several new illustrations of the extra-long flexible patented extension piece of the thermocouples. A partial list of users of these pyrometers, including about 1,400 names, is included near the end of the catalog.

Holophane Works of General Electric Company, Cleveland, O., has placed on the market a new product in its extensive line of illuminating glassware. It is called Druid glass and is a pure white opal of light density. This glass is pressed in iron molds and is, therefore, somewhat heavier than blown glasses. It has high reflecting efficiency and gives good diffusion. This glass is made in the form of reflectors of the Stonehenge design, which is a simple design with plain panels slightly relieved by shallow fluting. The surface of the reflector has no deep ridges for the accumulation of dust; the glass is smooth and easily cleaned. Six sizes of the Druid reflector are made and a recent bulletin issued by the company describes them and the characteristics of the glass.

Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., is sending out circulars calling attention of companies having overhead lines to the need of reinforcing them so as to prepare them for heavy sleet, snow and wind storms this winter. The company has large stocks of construction material on hand and is prepared to make prompt shipments. The company has also prepared a circular on what is called the "Other Ear" receiver. This is a convenient auxiliary to desk or wall telephones for converting any of them practically into as good as a long-distance instrument in a telephone booth. An auxiliary receiver is conveniently hung on the instrument so that when difficulty is experienced in understanding the message, a receiver may be placed at each ear.

Central Electric Company, 326 South Fifth Avenue, Chicago, Ill., has ready for distribution a special 80-page catalog of electrical Christmas-gift suggestions; this is designated as catalog No. 29. About 17 pages are devoted to various types of portable, desk, piano and similar lamps. About 16 pages give descriptions and illustrations of various types of electric heating devices; other devices listed are sewing-machine motors, electric washing machines, suction cleaners, self-winding clocks, electric fans, indirect and semi-indirect lighting units, pocket flashlights, electric bicycle lamps, electric Christmas-tree lighting outfits of various types, electrical toys, small motors, transformers, telegraph sets, bells, lighting specialties, etc. Copies of this catalog will be sent to anyone upon request.

The Vulcan Soot Cleaner Company, Du Bois, Pa., has issued a book entitled "Economical Steam Production." This is a 48-page publication very completely illustrated with line cuts and half-tones and describes the Vulcan soot cleaner for various types of steam boilers. The principle of this method is the use of steam blasts so directed and controlled as to clean the entire surface of every tube, dry high-pressure steam being used. The book gives many tests showing the comparison of the Vulcan method with others and the resulting economy from its use. The method has been adapted to almost every type of boiler. The bulletin can be obtained on application to the company or to **G. L. Simonds & Company,** 115 South La Salle Street, Chicago, who are acting as sales representatives for the Vulcan Company.

Wagner Electric Manufacturing Company, St. Louis, Mo., has just issued a new bulletin, No. 103, describing its new single-phase converter. The bulletin deals with the construction and the operating characteristics of the machine and is profusely illustrated with engravings of the machine and its applications. The single-phase converter is useful for any purpose demanding direct current when only alternating current is available. For electric-vehicle battery charging the control of the converter is effected by a specially designed switchboard panel which may be supplied with relays and instruments for controlling the battery charge and cutting off the current when the battery is fully charged. The converter has found an extensive application in moving-picture theaters for supplying direct current for projection arc lamps. On account of its simplicity of starting and its synchronous running it is being applied to X-ray apparatus for operating the synchronous interrupter.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports that among recent orders received were the following: For use in connection with the electrification of the Norfolk & Western Railway, orders for three 9,000-kilowatt, 25-cycle, 11,000-volt, single-phase turbo-alternators with two 150-kilowatt, 250-volt turbo-exciters and one motor-generator exciter of the same rating; one 200-kilovolt-ampere, three-phase, 25-cycle, 11,000/440-volt transformer; three 1,500-kilovolt-ampere single-phase 25-cycle, 33,000/11,000-volt autotransformers and six 2,500-kilovolt-ampere, and four 3,000-kilovolt-ampere autotransformers of similar characteristics; one 10-per-cent reactance for the 11,000-volt feeder circuit and one type TA voltage regulator for the turbogenerators. Chautauqua Traction Company, one 1,000-kilowatt self-starting commutating-pole, rotary converter, together with three 365-kilowatt transformers for reducing 2,400 volts to voltage of rotary, also three 500-kilowatt transformers, with 16,500-volt primary and 2,400-volt secondary. Greenville, Spartanburg & Anderson Railway Company, Spartanburg, S. C., one complete portable substation consisting of one steel car equipped with Burke switches, lightning arrestors and choke coils, one 500-kilowatt, three-phase, 60-cycle, 44,000/2,400-volt transformer, and one 500-kilowatt motor-generator set consisting of two 250-kilowatt, 750-volt, direct-current generators and one 720-horsepower, three-phase, 60-cycle, 2,400-volt synchronous motor and one direct-connected exciter. Pittsburgh Railways Company, Pittsburgh, Pa., three 500-kilowatt, rotary converters with three 550-kilovolt-ampere, 2,200-volt, three-phase transformers and one 14-panel switchboard for the control of same. United Railways & Electric Company, Baltimore, Md., one 2,000-kilowatt commutating-pole rotary converter; three 750-kilowatt, 13,200-volt, air-blast transformers and switchboard. Edison Electric Illuminating Company, Boston, Mass., two 750-kilowatt, 575-volt, 60-cycle, commutating-pole rotary converters with two 825-kilovolt-ampere, 13,200-volt, three-phase, air-blast transformers and two blower outfits for same. Cleveland, Painesville & Eastern Railway Company, Willoughby, O., two 500-kilowatt, commutating-pole rotary converters. Oakland, Antioch & Eastern Railway Company, Oakland, Cal., one 750-kilowatt, synchronous motor-generator set consisting of two 650-volt direct-current generators connected in series, and a 11,000-volt, three-phase, 60-cycle, motor with direct-connected exciter. Duquesne Light Company, Pittsburgh, Pa., one 300-kilowatt, induction motor-generator set, 600-volt direct-current side, 220 volts, three phase, 60 cycles alternating-current side. S. S. Bullis, Medford, Ore., one synchronous motor-generator set, consisting of 600-volt, direct-current generator and 2,200-volt, three-phase, 60-cycle synchronous motor, with switchboard. Milford & Uxbridge Street Railway Company, Medford, Mass., one 300-kilowatt alternating-current self-starting rotary converter; three 110-kilovolt-ampere, 13,200-volt, single-phase, 60-cycle transformers and switchboard.

Record of Electrical Patents.

Issued by the United States Patent Office, November 4, 1913.

1,077,278. Printing-Telegraph System and Alphabet. D. S. Hulfish, W. J. Herdman, and E. S. Lorimer, assignors to General Engineering & Construction Co., Toronto, Can. Has electromagnetically operated type blocks.

1,077,293. Coin-Controlled Mechanism. E. J. Ornold, Wheeling, W. Va. A motor circuit is closed when the coin occupies a certain position in a chute.

1,077,305. Luminous Switch-Key. M. T. Rosenheim, Philadelphia, Pa. Has

a transluscent body with an interior cavity containing a luminous substance visible from any angle.

1,077,307. Electric Horn. R. R. Root, assignor to Adams-Bagnall Electric Co., Cleveland, O. Has an electromagnetically actuated diaphragm.

1,077,319. Means for Controlling Electromagnets and Solenoids. L. L. Tatum, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. A switch for an alternating-current solenoid is shunted by a resistance when opened so that sufficient current flows to prevent demagnetization, but insufficient to hold up the plunger.

1,077,325. Spark Plug. W. S. Witter, Toledo, Iowa. Covers details.

1,077,355. Alternating-Current Electromagnetic Controller. D. L. Linquist, assignor to Otis Elevator Co., Jersey City, N. J. For an elevator motor, including an electromagnetic brake.

1,077,361. Electrograph. R. S. M. Mitchell, assignor to Talking Moving Picture Co., Syracuse, N. Y. A phonograph is electromagnetically controlled.

1,077,369. Fuse. E. E. Roberts, Hartford, Conn. A cartridge fuse with a number of communicating chambers.

1,077,372. Electrically Heated Sadiron. A. Shaler, Waupun, Wis. Includes a thermostat.

1,077,373. Telephone Transmitter. H. E. Shreeve, assignor to Western Electric Co., New York, N. Y. Covers details of construction.

1,077,374. Dynamo-Electric Machine. C. E. Skinner and T. S. Scott, assignors to Westinghouse Electric & Mfg. Co. Beneath the armature coil in each slot are folded commutating windings.

1,077,380. Quick - Break Switching Mechanism. H. G. Wellman, Cleveland, O. An electromagnet holds the switch closed until the opening device has moved a certain distance and then suddenly releases the switch.

1,077,395. Mechanically Operated Accelerating Mechanism. W. Deats, assignor to Otis Elevator Co. For an electric elevator motor.

1,077,398. Electric Fog-Signal Light. R. C. Douglas, San Francisco, Cal. Motor-operated feed mechanism for a powerful arc lamp.

1,077,426. Dynamo-Electric Machinery. C. A. Parsons, G. G. Stoney, and A. H. Law, Newcastle-upon-Tyne, England: said Stoney and Law assignors to said Parsons. Provides special windings and connections for a generator and motor.

1,077,429. Electrical Measuring Instrument. W. H. Pratt, assignor to General Electric Co. The series coils of a three-wire meter are interconnected to neutralize the effects of leakage flux on each moving element.

1,077,438. Magnetic Speedometer. J. K. Stewart, assignor to Stewart-Warner Speedometer Corporation, Chicago, Ill. Provides a rotating magnetic field and a thermostatic regulator.

1,077,444. Electrolytic Diaphragm. H. A. Wagner, New York, N. Y. A molded plate of granulated porous material contains metallic mercury, palladium black, and an oxidizing agent.

1,077,451. Electrical Controlling and Regulating Apparatus. G. T. Ashley, assignor to Fairbanks-Morse Electrical Mfg. Co., Indianapolis, Ind. For starting an induction motor.

1,077,479. Device Adapted to Show Whether an Electric Incandescent Lamp Has Been in Use. S. Klein, assignor to General Electric Co. The lamp is provided with a body dyed in a color sensitive to light.

1,077,507. Electric Storage Device. H. P. Ball, assignor to General Electric Co. A heat-storage stove with heat-insulated box, a number of removable disk-shaped metal heat-storage sections supported on end, and an electric heater supported independently of the sections.

1,077,532. Electric Sign. A. Hoehl, Haledon, N. J. Relates to the construction of the framework and casing.

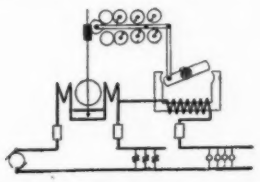
1,077,539. Battery Box. C. A. Mahla, New York, N. Y. Includes a dry cell, contacts therefor on the cover and a circuit-closer on the outside.

1,077,558. Trolley-Pole Retriever. C. B. Rodgers and J. A. Brennan, Bordentown, N. J. Relative movement of the pole and harp actuates a compressed-air retriever.

1,077,613 to 1,077,615. Controller for Electric Motors and Similar Devices. H. W. Leonard, Bronxville, N. Y. These three patents provide various ways in which release of the armature control arm by the no-voltage coil also throws the field-rheostat arm to starting position.

1,077,620. Well-Drilling Gear. S. J. Mathews, Kansas City, Mo. Has electrically controlled shoes to engage the walls of the well bore to prevent the stationary parts of the drilling motor from rotating.

1,077,626. Alternating-Current Apparatus. R. D. Mershon, New York, N. Y. A polyphase motor is adapted for operation on a single-phase circuit by means of adjustable reactance and capacity connected with the polyphase windings to give the desired phase relation therein.



1,077,729.—Lighting-Peak Meter.

1,077,627. Electrolytic Condenser. R. D. Mershon and J. S. Riddile, New York, N. Y.; said Riddile assignor to said Mershon. A series of filmed electrodes arranged side by side have collecting electrodes arranged to co-operate with two or more of them.

1,077,628. Electrolytic Condenser. R. D. Mershon. Has a transformer connected to the condenser electrodes, a rectifier connected between the electrolyte and transformer, and an independent source of current in parallel with the rectifier.

1,077,630. Key-Socket Attachment. E. N. Mincer, Chicago, Ill. A key-engaging clip with laterally extending arms and co-operating chains carried by the arms.

1,077,635. Electrical Resistance Unit. E. J. Ovington, Los Angeles, Cal. A flat resistance unit with wire threaded through rows of holes in an insulating sheet.

1,077,646. Electroplating Device. L. Schulte, assignor to Bennett-O'Connell Co., Chicago, Ill. In the tank is a rotary work holder.

1,077,658. Heating Unit. F. M. Vogel, assignor to General Electric Co. The framework of the unit consists of two side and several transverse strips, the resistance wire passing through the latter.

1,077,662. Motor-Control System. W. C. Yates, assignor to General Electric Co. Has an overload device rendered inoperative during the starting of the motor.

1,077,663. Incandescent-Lamp Hanger. R. D. H. Anderson, Cincinnati, O., assignor of one-half to W. R. Rockhold. Has a telescopically adjustable rod and tube and angularly adjustable hinge.

1,077,674. Production of Refractory Conductors. W. D. Coolidge, assignor to General Electric Co. In the process of making tungsten filaments a step consists in heating the shaped wire of tungsten powder and a binder of cadmium, mercury and bismuth in a current of gas to remove exuded metal and prevent the formation of surface globules.

1,077,675. Typewriter. M. C. Crawley, San Francisco, Cal., asignor to Addograph Co. Has electrical means controlled by depression of the key-bar whereby the push bar is operated to actuate the type bar.

1,077,676. Electric Heater. A. S. Cubitt, assignor to General Electric Co. A sectional heater comprises a number of channel-shaped supports, each having a resistance supended from the web and insulated therefrom.

1,077,696. Working Tungsten. C. T. Fuller. Assignor to General Electric Co. The process of rendering tungsten, which has become brittle during working, susceptible to further working by removing an outer layer of the metal.

1,077,706. Range Transmitter. J. L. Hall, assignor to General Electric Co. Comprises two synchronously operated shafts at the sending and receiving stations, the latter driving rotary indicators that are selectively and electromagnetically controlled.

1,077,711. High-Potential Insulator. E. M. Hewlett, assignor to General Electric Co. A sectional corrugated insulator post with means for adjusting a metal cap at the end.

1,077,717. Motor Control. W. P. Jackson, Oakland, Cal. On shutting off the current the armature is automatically short-circuited and then the series field is short-circuited.

1,077,725. Motor-Control System. C. Krämer, Berlin Germany, assignor to General Electric Co. The motors are connected with the controller for the field circuit through a differential gear.

1,077,729. System of Electric Metering. K. Markau, assignor to General Electric Co. Has two sets of dials, one recording all energy used and the other recording all energy used during individual peak lighting load only. (See cut.)

1,077,733. Means for Producing Slightly Damped Oscillations by Shock Excitation. A. Meissner, assignor to Gesellschaft für Drahtlose Telegraphie, M. B. H., Berlin, Germany. Includes a primary oscillation circuit containing a capacity, self-induction and two kinds of spark gaps of different characteristics, and a secondary slightly damped oscillation circuit coupled with and tuned to the primary circuit.

1,077,734. Terminal for Metal-Sheathed Wire. C. N. Moore, assignor to General Electric Co. A gap in the metal sheath near the end is surrounded by an insulating sleeve.

1,077,737. Motor-Control System. E. T. Murphy and J. E. Brobst, assignors to General Electric Co. Provides for automatically establishing a dynamic braking circuit.

1,077,739. Train Stop. A. R. Mutton, Waterloo, Iowa, assignor of one-half to O. P. Higdon. Includes electrically controlled air-brake valves and an electric alarm.

1,077,746. Snap Switch. J. G. Peterson, Hartford, Conn. Covers details of a rotary switch.

1,077,749. Maximum-Demand Electric Meter. W. E. Porter, assignor to General Electric Co. Has two gear trains, one driven by the meter and the other intermittently driven by clockwork.

1,077,751. Electric Incandescent-Lamp Carrier. A. F. Pribnow, Mellen, Wis. A packing tube with supporting collar for the base of the lamp.

1,077,753. Switchboard Circuits and Apparatus for Telephones. H. J. Roberts, Evanston, Ill., assignor to Homer Roberts Telephone Co. Relates especially to the ringing keys.

1,077,767. Auxiliarized Fire-Alarm Box. N. H. Suren, assignor to Gamewell Fire-Alarm Telegraph Co., New York, N. Y. Includes a series of electromagnetically controlled levers.

1,077,792. Voltage Regulator. W. S. Bralley, assignor to General Electric Co. A circuit shunted to the field circuit includes an aluminum electrolytic cell, a solenoid and means whereby the solenoid can operate the field rheostat arm.

1,077,802. Motor-Control System. F. E. Case, assignor to General Electric Co. A multiple-unit train-control system.

1,077,805. Magnetic Clutch. A. T. Collier, St. Albans, England, assignor of one-third to J. Dangerfield. Comprises an electromagnet with concentric pole pieces arranged circularly and a carrier with a number of narrow armature bars movably supported thereby.

1,077,817. Starting Device for Electric Motors. P. Dunning, assignor to General Electric Co. A starting compensator for a polyphase induction motor.

1,077,818. Detector for Printing Presses or the Like. G. T. Eagar, assignor to General Electric Co. A roller in contact with the web electromagnetically controls the motor circuit.

1,077,827. Process of Treating Tungsten. C. T. Fuller, assignor to General Electric Co. Consists in firing tungsten filaments in a packing of calcium carbide.

1,077,829. Circuit - Breaker. A. Guerra, Celaya, Mexico. Thermostatic switch.

1,077,866. Electrically Heated Cooking Device. H. P. Ball, assignor to General Electric Co. A grill consisting of a broiling chamber, a heating unit in the upper part thereof, a cooking vessel removably supported on the heating unit and a cover for the vessel.

1,077,877. Circuit-Closing Device for Doors. W. H. Fitch, Fort Worth, Tex. An automatic push switch in the jamb closes a lighting circuit when the door is opened. (See cut.)

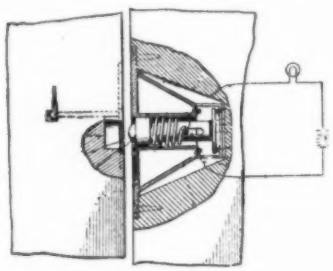
1,077,894. Electrode. R. H. Stevens, assignor to United States Smelting, Refining & Mining Co., Portland, Me. A platinum-plated tungsten electrode.

1,077,895. System for Electrically Controlling and Operating Railway-Traffic-Controlling Devices. H. B. Taylor, assignor to Federal Signal Co., Albany, N. Y. Electric signaling system.

1,077,913. Hammer Action for Musical Instruments. S. M. Keyte, Oakland, Cal. Electromagnetically actuated.

1,077,914. Commutator. R. E. Noble, Chicago, Ill. Special clamping-ring construction.

1,077,920. Electrode. R. H. Stevens, assignor to United States Smelting, Refining & Mining Co. An electrode of tungsten plated with iridium.



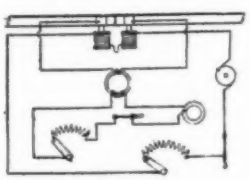
1,077,877.—Door Switch.

1,077,937. Train-Controlling Mechanism. R. T. Jones and F. T. Jones, assignors to Jones Safety Train Control System Co., Baltimore, Md. Electromagnetic control for an air-brake valve.

1,077,942. Dynamo-Electric Machine. G. Sayre, assignor to Apple Electric Co., Dayton, O. A constant-current self-regulating machine has two main brushes at right angles and an auxiliary regulating brush intermediate between the main brushes.

1,077,948. Circuit-Closing Device. W. W. Alexander; E. T. Keim, administrator of said Alexander, deceased, assignor to Protective Signal Mfg. Co., Denver, Colo. Mounted beneath the track rail so as to close the circuit on depression of the rail.

1,077,953. Method of and Apparatus for Electric Welding. E. A. Faller, assignor to K. O. Chisholm, New York, N. Y. Electromagnets attract the abutting ends of the work-piece to hold them in position while alternating current is passed through the ends to raise them to welding temperature. (See cut.)



1,077,953.—Butt Welding.

1,077,960. Spark Plug. H. M. Spencer, Dunmore, Pa. Relates to details of construction.

1,077,962. Coin-Operated Mechanism. P. Wiggen, assignor to J. P. Seeburg Piano Co., Chicago, Ill. An automatic piano electrically controlled and coin-governed.

1,077,965. Naval Fire-Control Apparatus. A. H. Pollen, London, and H. Isherwood, York, England. Has an electrical receiving mechanism controlled by a range finder for driving the target-bearing pointer a distance identical with the extent of training of the range finder.

Reissue 13,638. Induction Motor. K. A. Pauly, assignor to General Electric Co. Original No. 1,067,270, dated July 15, 1913. The speed can be varied by changing the number of stator poles and by external resistance in the rotor, the latter having also interconnected phase windings.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 10, 1913.

570,906. Electric Burglar Alarm. C. Coleman, Chicago, Ill.

570,911. Electrical Self-Playing Piano. G. H. Davis, New York, N. Y.

570,914. Dynamo-Electric Machine. G. E. Dorman, Chicago, Ill.

570,945. Electric Locomotive. J. E. McLaughlin, Philadelphia, Pa.

570,955. Automatic Safety Circuit-Closer. W. L. Pratt and F. E. Ripley, Adams, N. Y.

570,967. Electric Annunciator. J. Stamm, Stuttgart, Germany.

571,032. Electric Meter. C. Wirt, G. R. Green and H. Burger, Philadelphia, Pa.

571,036 and 571,037. Electric Meter. H. Burger and W. H. McFall, Philadelphia, Pa.

571,043. Electric Motor. G. R. Green, Philadelphia, Pa.

571,059. Electric Storage Battery. T. W. Allen, London, England.

571,063. Current Motor. M. G. Bunnell, Chicago, Ill.

571,092. Trolley for Electric Railways. P. C. Macevoy, Brooklyn, N. Y.

571,097. Automatic Circuit-Breaker. W. H. Powell, Hartford, Conn.

571,099 Electrical-Discharge Device. C. E. Skinner, Pittsburgh, Pa.

571,103. Lightning Arrester. A. J. Wurst, Pittsburgh, Pa.

571,107. Electrically Controlled Derails for Railway Crossings. J. P. Coleman, Edgewood Park, Pa.

571,109. Lightning Arrester. J. P. Culgan, Swissvale, Pa.

571,119. Electric Switch. W. W. Hibbard, Rochester, N. Y.

571,120. Electric Railway Trolley. H. D. Hinckley, Hartford, Conn.

571,123. Electric Lamp. R. M. Hunter, Philadelphia, Pa.

571,137. Electric Arc Lamp. H. R. Palmer, Norfolk, Va.

571,143. Electrode for Secondary Batteries. H. Woodward, Toronto, Canada.

571,162. Telephone Switch. E. M. Harrison, Chicago, Ill.

571,181. Field-Magnet Pole. J. J. Wood, Fort Wayne, Ind.

571,190. Magneto Telephone. E. M. Harrison, Chicago, Ill.

571,248. Electric-Light Attachment. J. H. Rusby, Nutley, N. J.

571,257. Electric Heating Apparatus. A. E. Appleyard, Natick, Mass.

571,271. Wire Fastener. J. C. Kremer, Wadsworth, O.

571,288. Electric Gas-Lighting Device. E. Schmidt, Berlin, Germany.

571,297. Electric Wall-Box. W. F. Bossert, Utica, N. Y.

571,300. System of Electrical Distribution. C. C. Chesney and J. F. Kelly, Pittsfield, Mass.

571,305. Magneto Generator. J. C. Francis, New York, N. Y.

571,310. Dynamo-Electric Machine. R. Lundell, Brooklyn, N. Y.